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Castings Important in Sewing the World's Clothing

WHILE a machine for stitching and sewing was patented in England in 1790, the first machine to become successful commercially was perfected in this country by Elias Howe around the middle of the last century. The great demand for uniforms during the Civil war spurred the inventive genius of the men early interested, and perfections in the sewing machine resulted in the elimination of much drudgery for the human race. Refinements in the various types of machines have been numerous, until now every article of clothing worn may be made by machine, from the finest lace and raised embroidery to heavy overcoats, shoes, etc., and handwork of all kinds may be imitated more or less successfully. Since the early day castings have been used extensively in the manufacture of sewing machines for the factory and the home, the products of the foundry being used for practically all of the major parts of the machine and in many cases for the stand. The value of sewing machines and attachments manufactured in 1923 was $46,150,392 as compared with $20,671,262 in 1921 and $14,033,253 in 1914. Thirty-six companies are included in this industry, of which 23 manufacture sewing machines.

Electric Motor Drives, Favored in Modern Machines, Require Castings

Find Where Castings May Be Sold

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Waterwheels Aid in

Major Product of Old Time Developing Natural Sources

According to a statement accredited to Executive Secretary O. C. Merrill of the federal power commission when addressing the American Institute of Electrical Engineers sometime ago at Birmingham, Ala., American industry is stepping forward briskly into a remarkable era of hydro-electric power plant development which has two tremendously important possibilities. The first embraces the saving of bituminous and oil fuel reserves for future and probably more urgent use. The second is connected with the distribution over wide areas of cheap electrical power direct from the utilization of the practically limitless waterpower available; waterpower, that in many cases, up to the present, has not even been considered as a source of potential energy. Records compiled over the past 17-year period indicate that the output from all central electrical stations has increased from six billion kilowatt hours to an estimated sixty billion kilowatt hours for the past calendar year. The erection of many other great plants is contemplated. The St. Lawrence river project which would connect many of the middle Atlantic coast states in one electric system extending back over the Ohio state line really has this for a primary object. The deeper water way phase of the project is only secondary in ultimate importance.

Today the federal government exercises control over 85 per cent of the country's waterpower resources. This is in line with the policy of conservation and the prevention of exclusively private control. This policy offers a marked contrast to the former wasteful exploitation of coal, timber, natural gas and oil. Projects providing for the installation of 2,400,000 horsepower under the federal act have been built during the 4-year period the act has been in force. This is equal to one-third of the total horsepower developed in the country at the beginning of the same period.

Develop Market

Present and future development of waterpower resources will exert an influence that will be reflected in many lines of business, particularly among manufacturers engaged in the production and installation of turbines, powerhouse equipment and generators, also feed lines which entail the use of vast quantities of copper and aluminum wire. To these must be added the thousand and one details of machinery, equipment for receipt and application of the power in sections of the country previously considered outside the zone of industrial development on account of the prohibitive cost of fuel to be used in the generation of power. Progressing from the general to the particular, it may be of interest to note some of the methods employed at the foundry of James Leffel & Co., Springfield, O., in the production of turbine wheels and accessories used in connection with the application of water power.

Old Established Business

First established in 1862 to engage in the manufacture of water wheels and other devices invented by the founder, the business has grown steadily until today it is capitalized at $1,750,000. For one reason or another several sites have been occupied for varying periods of time. The present plant built in 1916 and which practically is new represents the latest accepted ideas in industrial building construction and layout. It occupies an extensive property near the outskirts of the city and paralleling the main line of the Big Four railroad. A convenient spur enters the company's property and is divided into several branches that facilitate the delivery of raw material to the various storage stations. The completed pieces of machinery are loaded on railroad cars that enter through one end of the long machine shop.

The plant both in general layout and in detail was designed by A. F. Sparks, president and general manager of the company and was erected under his personal supervision. He has been connected with the company for over 30 years. Beginning his career as a young engineer in the drafting room and gradually advancing to his present position he had

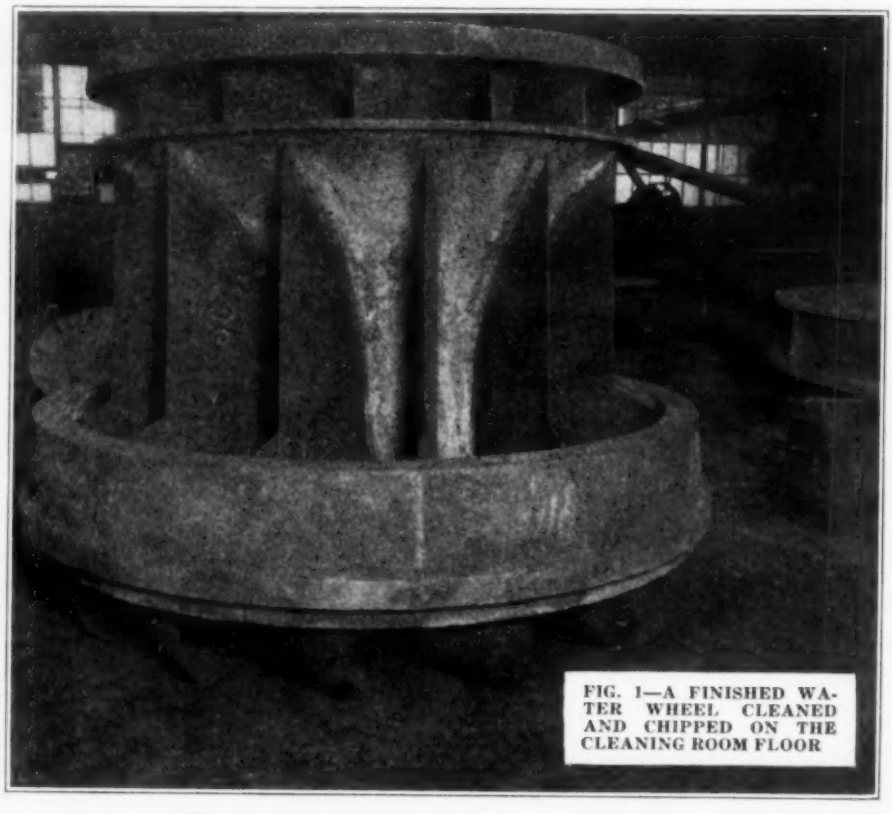


FIG. 1—A FINISHED WATER WHEEL CLEANED AND CHIPPED ON THE CLEANING ROOM FLOOR

Power Plant Advance

Ohio Foundry Devoted To of Hydro-electric Power

By Pat Dwyer

opportunity to arrive at a definite conception of a plant particularly adapted to the company's individual and peculiar requirements. As an engineer-salesman over a period of several years he was brought into intimate contact with power plant installations all over the country and in that manner acquired a fund of knowledge connected with every angle of the waterwheel manufacturing business. Big, bluff, hearty, with a naturally inventive and mechanical type of mind, with the trained engineer's love for order, neatness and efficiency, the plant considered either collectively as a producing unit or examined in any of its component parts reflects the ideas and individuality of its moving spirit.

Steam engines and boilers are made in this plant in considerable numbers and the methods practiced in the production of the castings present many points of interest. However, prime movers designed to be driven by water power engage the greater part of the company's manufacturing capacity. Special equipment together with waterwheel molds in various stages are shown in the accompanying illustrations. The assembled unit is made up of several parts, but since the casting forming the runner presents the most interesting features, the different steps in the formation of a mold will be considered somewhat in detail. Molds for small wheels, that is wheels up to about 4 feet in diameter, are rolled over as shown in Fig. 2, but larger wheels, of which the casting shown in Fig. 1 is typical, are built around a spindle.

Steel Buckets

Wheels are made according to three main designs: With a single set of steel buckets; with a double set of buckets, one steel and one cast iron; with a single or double set of bronze buckets. The energy derived from a water wheel depends to some extent on the head of water under which it operates, but it depends to a greater degree on the size and shape of the buckets and the accuracy with which they are spaced around the wheel. A wheel may be designed to generate any horsepower within reason under any head of water, but the two main factors in its efficiency are the angle and the area of each vane and the absence of friction with which the spent water is discharged into the tail race. Wheels with single buckets usually operate at high speed under a high head of water. Wheels with auxiliary buckets operate at a slower speed under low heads and bronze wheels are designed for use under conditions where the water exerts a corrosive influence.

The greatest care is observed in bending the steel buckets to the correct shape and an equal degree of care is exercised in placing them in the mold in such a manner that the spaces between remain absolutely uniform. The design of the bucket as determined by the engineering department is submitted to the pattern shop where it is converted into tangible shape as a block bearing on one face a fac-simile of the desired bucket. This block is taken to the foundry and reproduced in iron. After it is cleaned the working surface is gaged accurately all over and minor surface inaccuracies are corrected. It then is taken to the boiler shop and set up at a convenient place on the floor. The steel plate to form the bucket is laid out on the surface plate and marked to the approximate shape required. It is sheared and heated and then hammered down into the cavity in the block until it rests evenly in contact with the surface all over. Minor adjustments are made along the edge where required and a row of holes is punched in the two edges of the plate destined later to be bedded in the cast iron frame of the wheel.

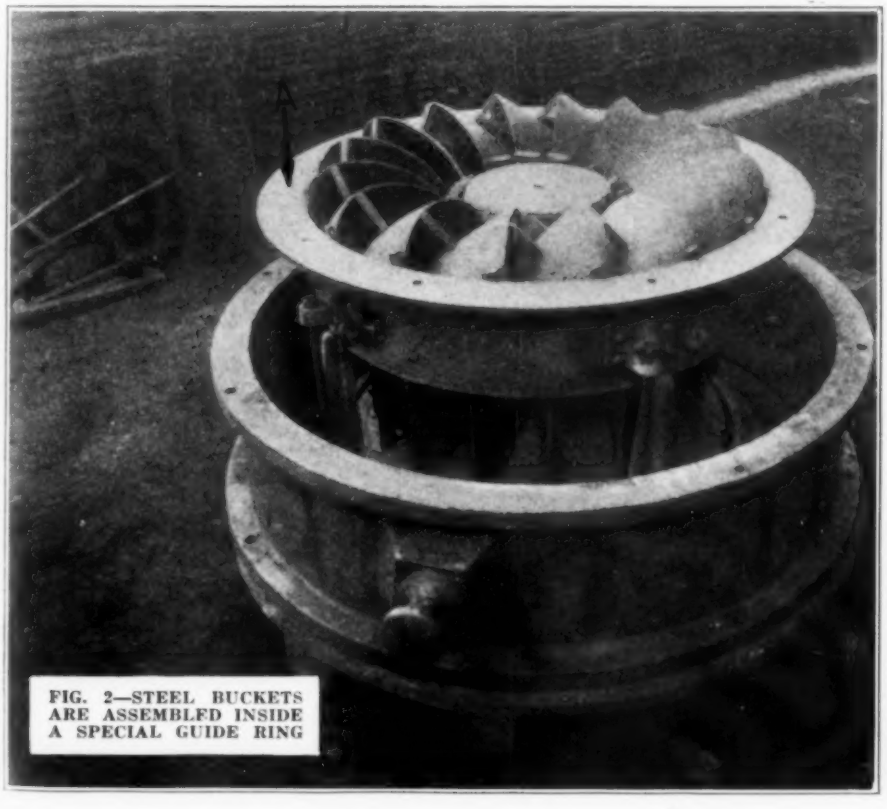


FIG. 2—STEEL BUCKETS ARE ASSEMBLED INSIDE A SPECIAL GUIDE RING

Mold for Small Wheel

Special equipment and the manner in which the mold for a small wheel is commenced are shown in Fig. 2. The rollover board is leveled at a convenient space on the foundry floor. The board is provided with a cone in the center which corresponds to the opening in the desired casting plus the thickness of sand in the core

FIG. 3—TO INSURE ACCURACY THE MOLDS ARE BUILT ON A CAST IRON PLATE MACHINED TRUE ON ONE SIDE AND SET LEVEL ON A CONCRETE FOUNDATION

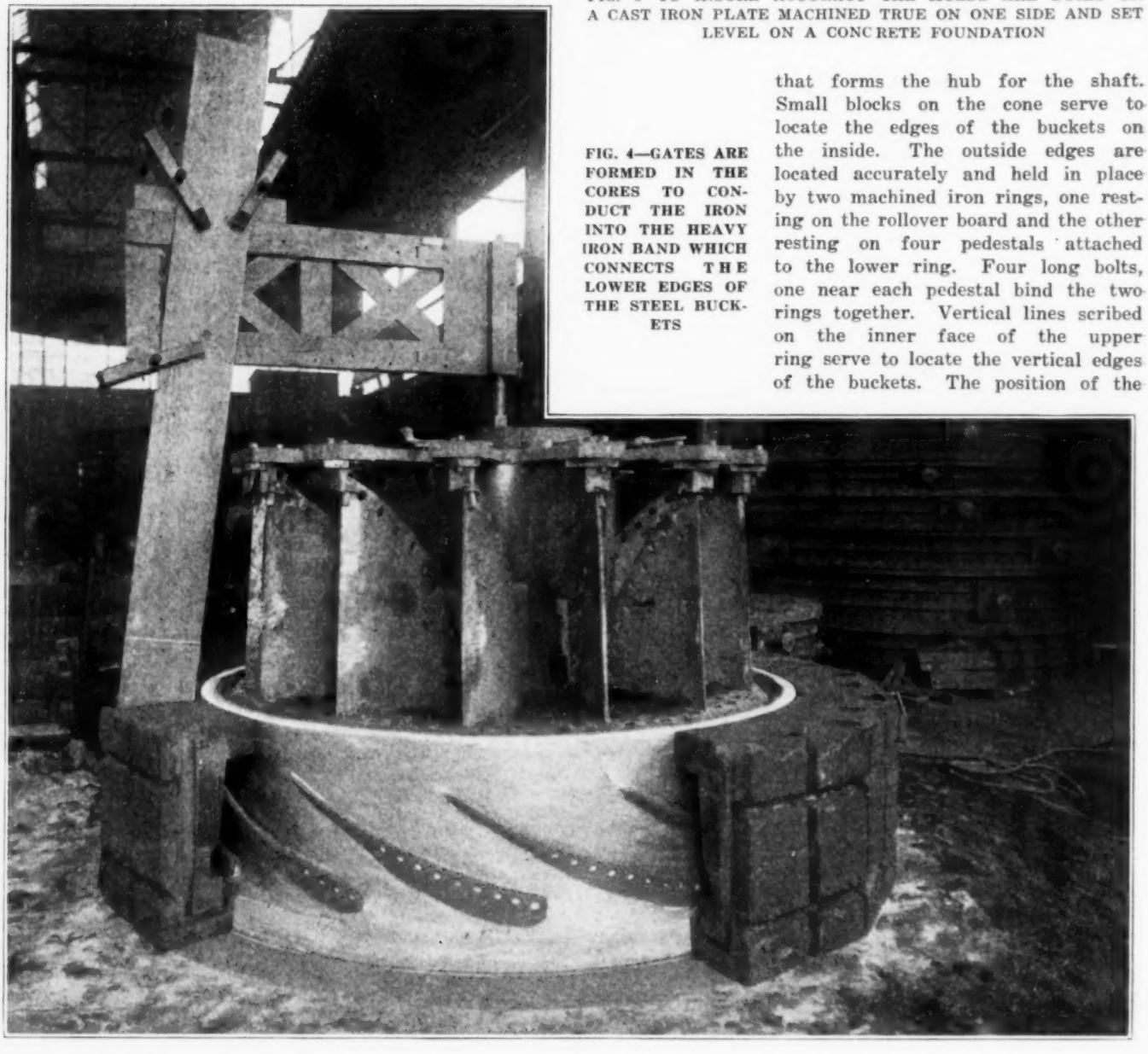


FIG. 4—GATES ARE FORMED IN THE CORES TO CONDUCT THE IRON INTO THE HEAVY IRON BAND WHICH CONNECTS THE LOWER EDGES OF THE STEEL BUCKETS

that forms the hub for the shaft. Small blocks on the cone serve to locate the edges of the buckets on the inside. The outside edges are located accurately and held in place by two machined iron rings, one resting on the rollover board and the other resting on four pedestals attached to the lower ring. Four long bolts, one near each pedestal bind the two rings together. Vertical lines scribed on the inner face of the upper ring serve to locate the vertical edges of the buckets. The position of the

buckets is checked in relation to the marks on the inside and on the outside and also in relation to each other. When they finally have been adjusted to show not more than a variation of 1/64-inch from absolute accuracy they are blocked in the center of the discharge curve and wedged against the inside rim of the upper guide ring as shown in Fig. 2. Two flask rings then are placed on the rollover board and green sand is rammed between and around the steel buckets up to and including the upper retaining and guide ring. A third ring which is the real drag then is placed in position and also rammed full of sand. A bottom board is adjusted in place, the entire assembly is clamped and rolled over.

All the foregoing work is preliminary and serves merely to locate the steel buckets definitely and accurately in the drag. The clamps are removed followed by the rollover board, the two flask rings and the guide rings and the pedestals. The guide ring *A*, Fig. 2 in addition to holding the buckets in place also provides a seat for a set of segment cores that form the mold for a cast iron band around the buckets. This stage of the mold, although on a different wheel and made in a different manner is illustrated in Fig. 4. When the guide ring first is removed only the edge of the steel insert is exposed. The molder with a sharp trowel or double ender cuts the sand away on both sides of the exposed insert to form a heavy fillet. The molten iron

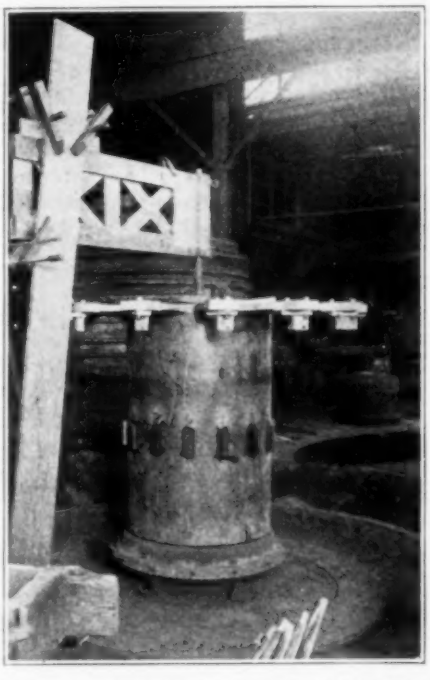


FIG. 5—EQUIPMENT FOR LOCATING BUCKETS

FIG. 6—STEEL BUCKETS ARE ATTACHED FIRMLY AND ACCURATELY IN PLACE

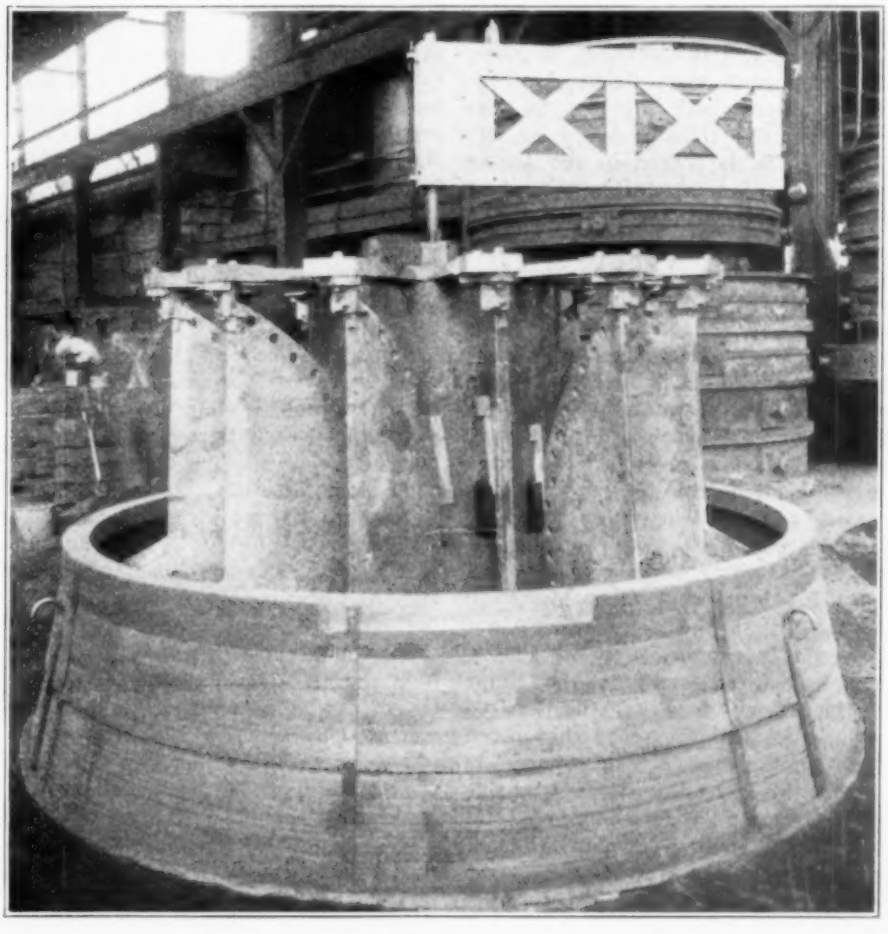


FIG. 7—A RING IS USED TO SHAPE THE SAND AROUND THE BOTTOM

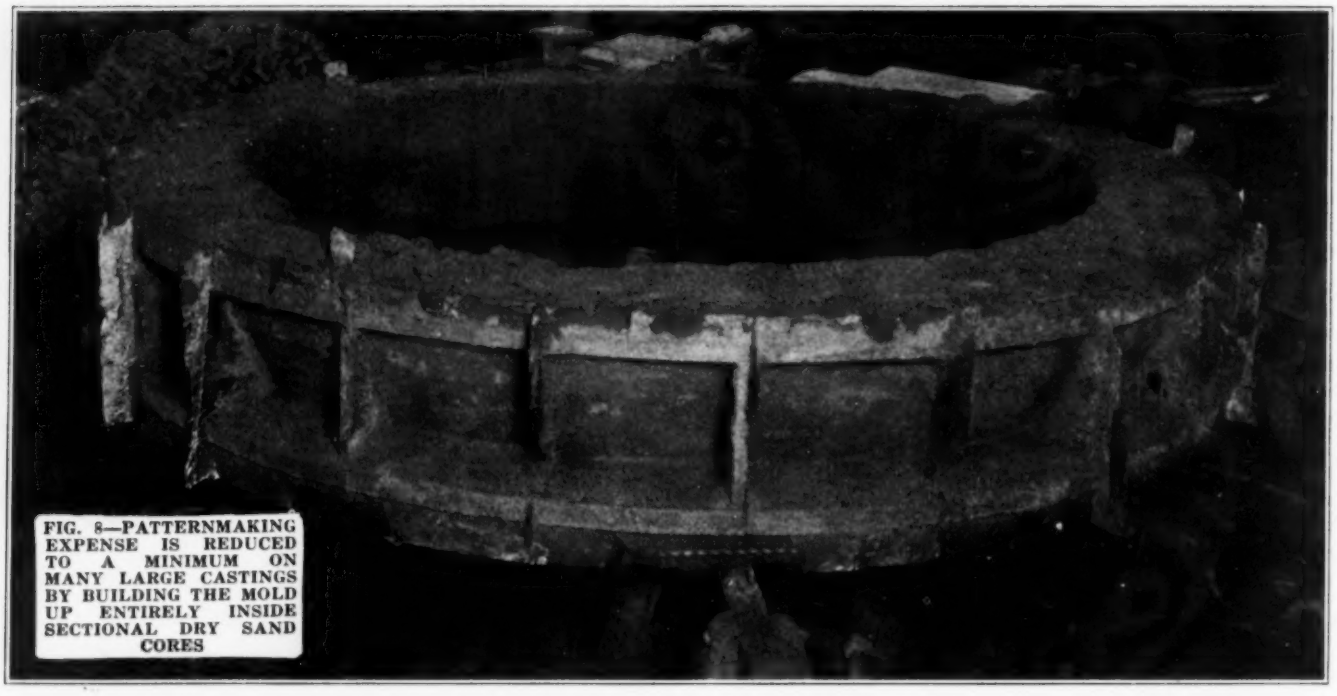


FIG. 8—PATTERNMAKING EXPENSE IS REDUCED TO A MINIMUM ON MANY LARGE CASTINGS BY BUILDING THE MOLD UP ENTIRELY INSIDE SECTIONAL DRY SAND CORES

later enters this fillet, flows through the holes in the edge of the plate and anchors the bucket firmly in place. The exposed parts of the steel buckets are painted with red lead mixed with half and half turpentine and gasoline.

After the fillets have been cut and the green sand surface brushed with plumbago, a set of segment cores similar in general respects to those shown in Fig. 4 is assembled in place. Then the two ring flasks are returned and rammed full of sand. The cone from the rollover board or one similar to it, is placed in the center to form the opening inside the wheel also the flange around the top. The flasks are adjusted with wedges between the flanges, to bring the face of the upper flange flush with the upper face of the flange on the pattern. A flat parting is made between the edge of the flask and the flange and then the pattern is removed. A fillet is cut on each side of every exposed bucket edge to provide space for the molten iron to grip the perforated edges. The loose sand is cleaned out of the bottom of the mold after which the surface is brushed with plumbago and the bottom and hub cores are set. The cope is rammed upon a follow-board which conforms to the shape of the upper face of the desired casting. After the cope has been placed on the drag a long runner box is made up extending from one side to the center and embracing two runners, one leading down to the cavity enclosed by the ring cores and the other leading to the cavity forming the hub and inner web of the wheel. The stream of metal from the ladle is directed in a manner to fill both cavities as nearly simultaneously as possible.

One of the foundation plates on which the molds for large wheels are erected is shown in Fig. 3. It is a one-piece, cast iron plate machined to a true plane on one side and anchored firmly and level on a concrete foundation. Some of the auxiliary equipment for locating the buckets is shown in Figs. 5, 6 and 7. It may be noted that four contact points are provided for each steel bucket, one on the bottom ring, one on the flange attached to the spindle seat, one at a point half way up on the central drum and one at the extremity of a spider arm attached to the central spindle.

Owing to some slight variation in forging the buckets, they do not all show a uniform weight. Cognizance is taken of this feature in distributing them around the wheel. Each blade of the set is weighed and marked before it is placed in the vicinity of the mold for assembling. The man responsible for the makeup of the wheel takes the list of weights and decides on the proper position for each bucket to insure a balanced wheel, one that will run smoothly at high speed. He marks the weight on the end of each spider arm and the workmen assembling the buckets select the bucket corresponding in weight to the figures on the end of each spider arm and erects it at that point.

The weight of the bucket is supported on the lower ring plate. The inside edge rests against the temporary central drum and the upper peak of the vane is bolted to a small bracket attached to the under side of the spider arm. Suitable gages are employed to insure accuracy in spacing the buckets. The flat ring *B*, Fig. 6, is blocked and wedged up from the foundation plate to serve as a true seat for the segment cores. It is adjusted accurately by a long board attached to the sweep arm. Under ordinary circumstances a sand bed formed under the end of the sweep is considered sufficiently accurate to serve as a core print, but in the case of turbine wheels where a variation of ⅛-inch is not tolerated the sand bed is replaced by the solid flat ring shown in Figs. 4 and 6.

Note—This is the first of two articles by Mr. Dwyer on molding practice followed in making waterwheels. The second will appear in an early issue.

The Editors.

Made Sales Manager

Henry Disston & Sons, Inc., Philadelphia, have appointed H. A. Baxter manager of the steel sales department, succeeding Charles T. Evans, who has retired, on account of poor health, after many years as manager of the department. Mr. Baxter has been general manager of sales for the Tacony Steel Co. and the Penn Seaboard Steel Corp., Philadelphia, for the last three years. Prior to that he was associated with the H. H. Franklin Automobile Co., the Midvale Steel Co., and the Tacony Ordnance Corp.

Louis F. Ferster, advertising manager of the Werner G. Smith Co., Cleveland, recently was elected Justice of the Peace of Bay Village, a suburb of Cleveland.

Pulverize Coal at the Furnace

Coal Is Prepared for Use in an Individual Device Close to the Furnace Instead of Being Piped from a Central Station

By E. C. Kreutzberg

WHAT is claimed to be an important feature in reducing production costs in the malleable castings industry takes the form of a new type of coal pulverizer directly connected to the consuming unit and known as a unit pulverizer. Without storage or any other intermediate facilities, it pulverizes coal for immediate consumption in the furnace or oven unit to which it is attached.

Definite figures are not available up to the present, but it is admitted that the use of the unit pulverizer has effected a saving of considerably more than 25 per cent in the total melting costs as compared with the cost of operating a hand fired furnace. These savings are distributed over practically every item of the melting cost and include cost of coal, firing labor, ash disposal, slag removal, metal charge, kindling the fire, skimming rods, power, fire brick and mason labor. A saving also is effected through a reduction in the furnace loss.

These results are the outgrowth of a sweeping investigation undertaken at the plant of Kuebler Foundries, Inc., Easton, Pa., early in 1925 with a view of obtaining maximum efficiency from its coal consuming units. About that time the Grindle Fuel Equipment Co., a subsidiary of the Whiting Corp., Harvey, Ill., had perfected a unit pulverizer for which it was seeking an initial installation. Arrangements were perfected to try it out at the Kuebler plant under a guarantee that the pulverizer would effect a minimum saving of 25 per cent in the total melting costs of a 20-ton reverberatory furnace built by the Grindle Fuel Equipment Co.

The equipment was completed and placed in operation in September. While exact figures on the actual operating costs have not been given out, adoption of the method by other plants would seem to indicate that the results are up to expectations. One prominent agricultural implement maker has ordered 22 of the new unit pulverizers. A large malleable iron company in the east has ordered a number and several other companies have ordered one each.

In general it may be stated the new apparatus comprises a receiving hopper, a bucket elevator, a vertical waste heat dryer, the pulverizer itself, which supplies air to carry the pulverized coal away from the pulverizer and a secondary exhauster which supplies additional air for combustion.

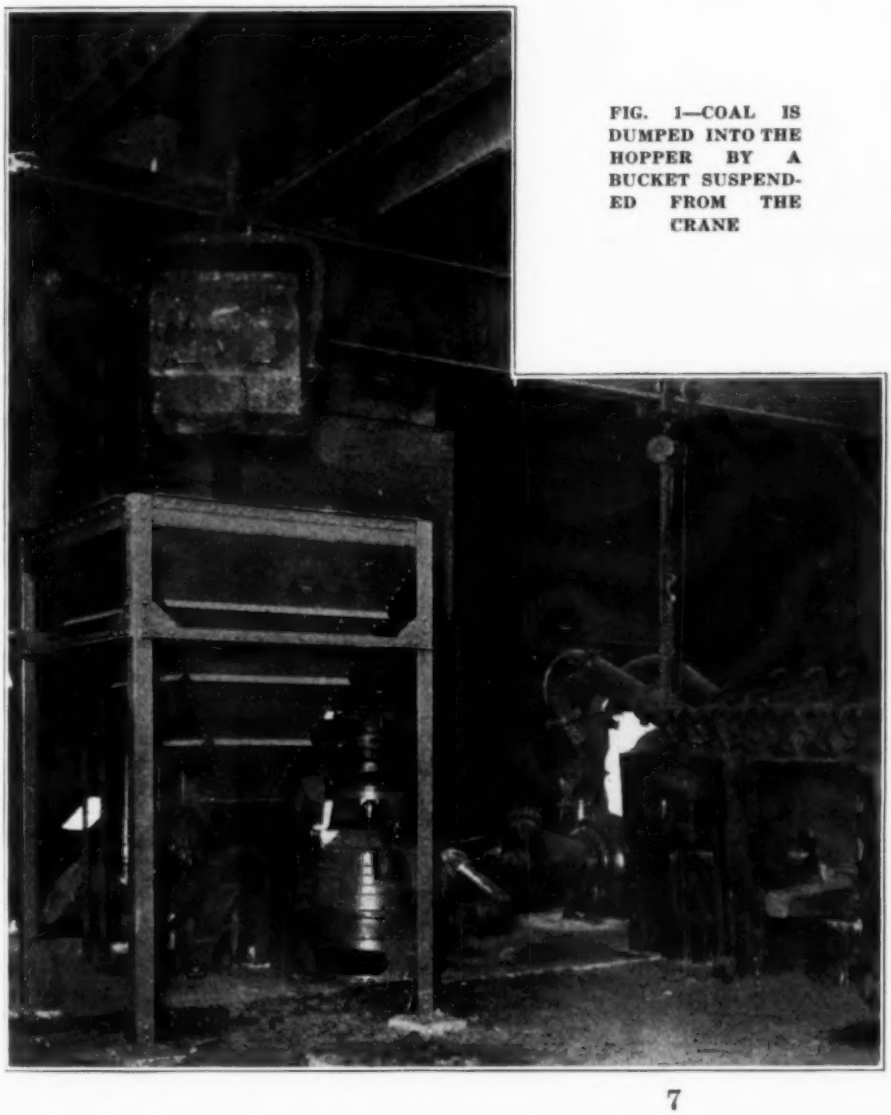


FIG. 1—COAL IS DUMPED INTO THE HOPPER BY A BUCKET SUSPENDED FROM THE CRANE

Method of Operation

Coal in dump buckets is brought to the pulverizer by an overhead traveling crane. It is dumped into the hopper as shown in Fig. 1 and then elevated by the bucket elevator and dumped into the drying chamber. This feature clearly is shown in Fig. 3. Here the coal is dried by the waste heat from the furnace. From the drying chamber the coal passes through a chute and is discharged on to an endless belt. This belt travels over a magnetic pulley which removes small pieces of tramp iron or steel such as frequently are found in the coal. Through another chute the coal then passes to a pulverizer of the vertical shaft type designed in five stages. It is enclosed in a cast iron beehive housing. The interior of the housing is provided with high carbon steel pulverizer rings with corrugated interior surfaces.

The rotor consists of five steel disks with manganese steel beaters centered on a vertical shaft operating through a flexible coupling at a speed of 1800 revolutions per minute. When the coal falls into the pulverizer from the feeder it drops on the rapidly revolving top disk from whence it is thrown out against the pulverizer ring. As it rebounds the beaters strike

FIG. 2—SHOWING THE RELATIVE SIZE, SHAPE AND POSITION OF THE PULVERIZER UNIT IN RELATION TO THE FIRING END OF THE FURNACE

it after which it falls down on to the second disk. This operation continues through the five stages, after which the pulverized coal falls under the rotor. The bottom of the rotor is equipped with fan blades which furnish sufficient air pressure to blow the coal through pipes to the secondary exhauster where additional combustion air is added and then through the burners into the combined combustion and heating chamber of the melting furnace. The amount of air which the exhauster supplies is controlled by a hand lever which accurately regulates the size of the openings in the exhauster fan casing.

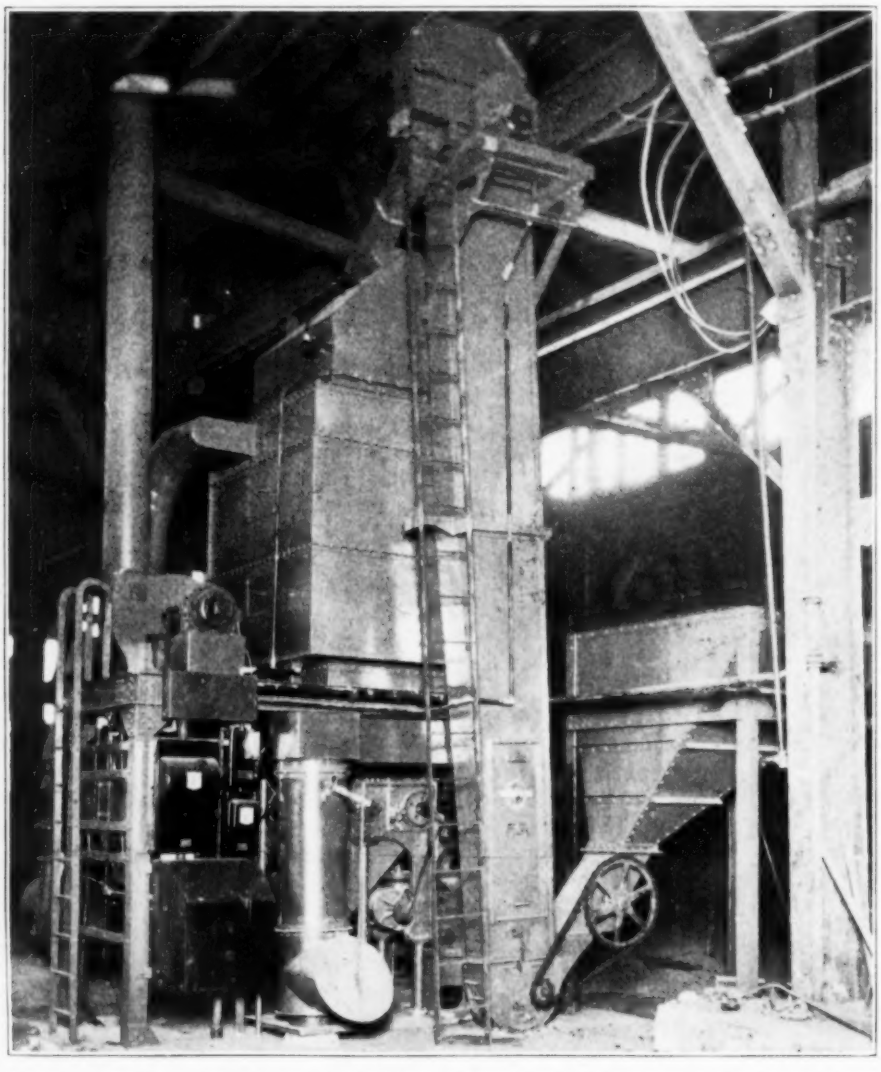


FIG. 3—GENERAL VIEW OF AUXILIARY EQUIPMENT SHOWING HOPPER, DRYING CHAMBER AND ELEVATOR

Formerly the Kuebler Co., bought lump, low sulphur, gas coal of the highest grade. At present owing to the effects of the anthracite coal strike, this coal is bringing $6 to $8 a gross ton, f.o.b. western Pennsylvania mines. The company now purchases coal of the same grade, but owing to its ability to accept anything that goes through a 1½-inch mesh, it is able to buy coal at $1.95 a gross ton at the mines.

An interesting feature of the present operation of the furnace is that the ash is so small as to be negligible. The coal now being used is sold as containing 8.55 per cent ash, but the actual ash accumulation is insignificant.

Another advantage claimed for the present method of firing is that the temperature of the furnace may be raised to the desired degree more quickly than in the hand firing days. Also the heat is controlled more easily. The heats are turned out in less time. Kuebler Foundries, Inc., now contemplates the erection of new annealing ovens to be equipped with a unit pulverizer. The company's plans also call for the equipment of additional melting furnaces.

Elected President

J. M. Price has been elected president of the Electro Metallurgical Sales Corp., New York. He has been succeeded as vice president by William J. Priestly, who formerly was metallurgical engineer at Pittsburgh.

Dead-burned dolomite is used considerably as a refractory. In 1924 a total of 483,200 tons of dolomite valued at $3,496,394 was sold or used for refractory purposes. This does not include dolomite used as a flux or for other purposes.

Controlling Molding Sand in *a Radiator Shop-II*

By H. W. Dietert and W. M. Myler Jr.

FINENESS test of molding sand shows the percentage of sand grains retained on each screen of a series of ten screens. Grain sizes and distribution of sand grains are determined by knowing the percentages of sand grains remaining on each screen. The amount of objectionable grain sizes, as pan material, which is exceedingly fine, and the large poor crystalline grains also are indicated definitely. The premeability of a sand in its natural form shows its ability to pass gases. The amount of clay substance contained in the sand will affect materially the permeability of the sand. Thus a reduction of the clay content of the sand will change the permeability of the sand. Whenever a new high bonded molding sand is added to the heap sand a large portion of the new clay bond is taken up by the heap sand, which will increase the permeability of a new sand. In this way a comparatively dense high bonded sand may become a much more open sand by the reduction of its clay content.

If the natural permeability only is considered in the selection of sand, the low bonded molding sand will show a higher permeability, as a rule, than the high bonded molding sands. If the permeability of a high and of a low bonded molding sand, is determined, the test may show that the low bonded sand is more permeable. Should the clay substance in a high bonded molding sand be reduced to the same percentage as that of the low bonded molding sand, then it is possible that the permeability of the high bonded sand would be the greater. A molding sand may be inherently dense due to its grain size distribution or to a larger percentage of exceedingly fine material which will be retained on a 270 screen or on the pan. In some sands the percentage of pan material is as high as 20 per cent. The permeability of the grain structure is the controlling factor of the permeability of the sand. The clay content of the heap sand always is maintained within a somewhat reasonable limit. The variation of the clay substance in the heap sand will cause an increase or decrease of permeability above or below the permeability of the grain structure of the heap sand. Thus it may be seen how important it is to have the base or grain structure of a sand with a desirable permeability. The permeability or grain structure without the clay will be called the base permeability.

Apparatus required to make the various tests and base permeability determinations are as follows: Four 1-quart large mouth bottles; one 2-foot length of ¼-inch rubber tubing; one screen shaking machine; one permeability test specimen rammer one permeability apparatus; one 2-inch specimen container equipped with circular retaining screens; one set of screens as follows:

Screen No.	Opening in inches
6	0.132
12	0.066
20	0.033
40	0.0165
70	0.0083
100	0.0059
150	0.0041
200	0.0029
270	0.0021
Pan	

Approximately 350 grams of sand to be tested is placed in an oven and dried for a period of one hour at 212 degrees Fahr. with a tolerance of 5 degrees. A 300 gram sample of the dry sand then is placed in a quart bottle. A sufficient amount of caustic soda solution is added to wet completely the sand in the bottle. The bottle is filled with water, after which procedure the sand in the bottle is agitated by up-ending the bottle by hand or by a machine. The clay substance contained in the sand is torn apart by the caustic soda, which makes it possible for the clay to be in colloidal suspension.

Sand grains are freed from the clay bond in a similar manner as soap will remove grease from the hand. The bottle containing the sand sample is allowed to stand for five minutes that the fine sand grains may settle. The water containing the clay is syphoned out with a rubber tubing being held ½-inch from the level of the sand grains in the bottle. The water is added repeatedly and syphoned off at one minute intervals until the water becomes clear. The sand grains then are dried and weighed.

Loss in weight is the amount of clay substance contained in the sand. A sufficient amount of sand to make a rammed sand specimen with a length of two inches then is placed in a permeability sand specimen container. The sand specimen is rammed by three blows of a 14-pound weight dropping 2 inches. The dry sand is held in position in the specimen container by placing old screens on each end. The container next is attached to the permeability apparatus and the amount of air flowing through the specimen is determined, thus obtaining the base permeability of the sand. A 100 gram sample of sand is placed on the top screen of the screen set, which are stacked one on the other. The screens are then placed in a shaking machine, preferably of the ro-tap design. This machine shakes the screens in a circular plane and taps them on the top. After shaking the screens for a period of ½ hour the amount of sand grains retained on each screen is weighed and expressed in percentage.

Test values of the characteristics of

DETERMINATION of the percentage of clay, the base permeability and the sieve test commonly are known as the fineness test and form an important step in the control of molding sand in the foundry. Numerical values showing the comparative bonding qualities of molding sand are obtained from the strength test. Laboratory methods of conducting these tests, which are being used by the United States Radiator Corp., Detroit, in its various plants, are outlined in this article, which is the second of a series of three abstracted from a paper presented at the Syracuse meeting of the American Foundrymens' association, Oct. 5-9. The various differences in the methods used by the United States Radiator Corp., and those recommended by the sub committee of the American Foundrymens' association., are introduced by the authors who are connected with that company.

Table II

Comparative Test Values of Sand

Characteristics	No. 3 Boiler Heap Sand-Detroit	No. 3 Sand H. & H.	Worden Pit	No. 7 Zanesville Sand—West Newton Plant	No. 4 Brandon Sand
Max. strength	3.0	8.0	3.0	13.5	5.25
Max. permeability....	37.0	2.5	21.0	22.0	6.5
Base permeability....	42.0	10.0	24.5	31.5	1.0
Percentage clay	16.7	43.0	15.0	40.0	16.4
Fineness Test					
6	0.7				
12	3.4				0.8
20	10.9	0.1	0.5	1.0	4.7
40	12.3	1.20	2.2	1.4	12.3
70	32.1	39.0	12.7	14.1	19.8
100	22.0	22.60	24.9	41.0	15.6
150	10.2	6.60	26.8	28.5	12.9
270	4.8	5.6	15.0	7.2	10.3
Pan	1.9	24.7	11.8	4.0	20.0

various sands are tabulated in Table II, showing the effect of clay substance and grain structure on the permeability of molding sands. It may be noted that the maximum permeability of the No. 3 boiler heap sand (Detroit plant) is 37, and after the 16.7 per cent of clay substance is removed, the base permeability of 42, is obtained. The fineness test shows that the grain sizes of this sand are distributed over a large range. The amount of pan material of 1.9 per cent is exceedingly low. To increase the permeability of this sand the grain structure of the sand must be broken up by the addition of a uniform new sand consisting of approximately No. 10 sand grains.

The H. & H. sand showed a maximum permeability of 2½. Its base permeability is 10, showing that the high clay content of 43 per cent closes up this sand to one-fourth of its base value. The fineness test shows that the sand contains 24.7 per cent of pan material, which is an excessive amount. This sand would be open, provided it did not contain this fine pan material. The pan material not only closes the sand but will float in molten iron should the sand become weak.

Permeability of the Worden pit sand is affected little by the removal of clay substance. The fineness test shows that the sand contains 15 per cent of No. 270 screen and 11.8 per cent of pan material. This quantity of fine material limits the permeability of the sand and also causes dirty castings provided the heap sand becomes weak.

The No. 7 Zanesville sand as used at the West Newton plant has a maximum permeability of 22 and a base permeability of 31½, showing an increase of 9½ after the 40 per cent of clay substance was removed. The grain size distribution of this sand is good. The base consists of sand grains retained on the No. 100 screen. The grouping of the grain sizes one below and one above the base also is desirable. The amount of fine material in this sand is sufficient to give the sand a comparatively good texture.

A comparison of the maximum permeability of the Worden pit and No. 7 Zanesville sands indicates that both of these sands are of the same openness. However, the base permeability shows definitely that the No. 7 Zanesville sand is the more permeable. The base permeability is the more practical criterion in this case because the clay substance in the No. 7 sand would be reduced materially when mixed in the floor heap sand.

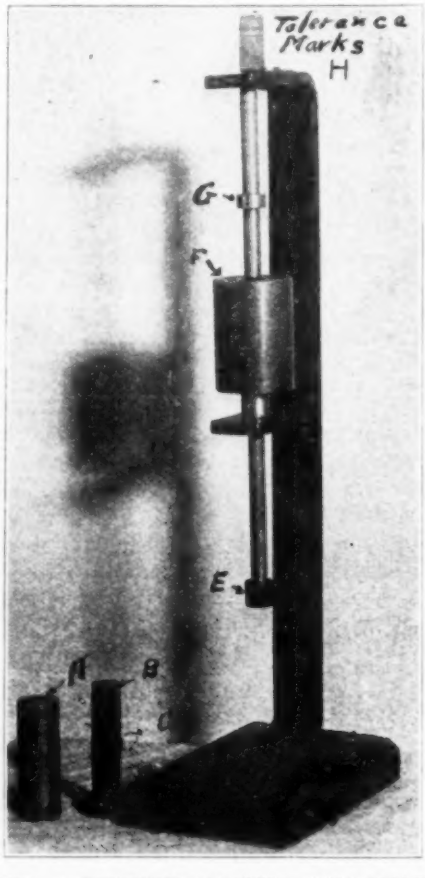


FIG. 4—STRENGTH RAMMER WITH MOLD AND BOTTOM RAMMER

A sand which has a lower base permeability than its natural maximum permeability is the No. 4 Brandon sand. Its maximum permeability is 6½ while its base permeability is 1.0. In this case the clay substance is sufficient to coat each sand grain, and does not fill up voids. An examination of the fineness test will show that 10.3 per cent of the sand was retained on the 270 screen and 20 per cent on the pan. This makes a total of 30.3 per cent of fine material, which gives the sand a dense grain structure. The wide distribution of grain sizes also helps to close up this sand.

Determination of the base permeability and fineness test makes it practical to determine why a molding sand has a permeability of a certain value and also how its permeability may be changed. The fineness test shows the exact amount of clay substance contained in the sand and also the distribution of the grain sizes. Considerable advancement may be made by a further study and application of these properties of a molding sand to shop practice and results obtained in the plants from various molding sands.

Fineness Test Procedure

For percentage clay:

1. Obtain a representative sample of heap sand not less than 500 grams.
2. Dry sample of sand in oven at 212 degrees Fahr. for 1 hour.
3. Cool sample and weigh out a 300 gram sample. Do not pour sand to obtain this sample—use the scoop.
4. Place the 300 gram sample in a 2-quart jar.
5. Add approximately 250 cubic centimeters of 1 per cent sodium hydroxide solution. This solution is made by measuring out 1000 cubic centimeters of water with the 500 cubic centimeter flask. Then add 10 grams of sodium hydroxide to the 1000 cubic centimeters of water.
6. Fill the jar containing the sand sample with water within 2 inches from the top.
7. Clamp top on jar and shake violently for five minutes.
8. Hold jar still for a minute. Then shake jar sufficiently to wash sand grains off the jar cap. Next remove cap.
9. Let stand for 10 minutes.
10. Fill the rubber tube with water. Pinch one end and insert other end into jar until one inch from sand grain level.
11. Release the pinched end of tube and syphon out water to 1 inch above sand grain level.

12. Fill jar with water. Let water stream stir sand grains.

13. Syphon after 5 minutes standing.

14. Repeat operations 12 and 13 until the water is clear after 5 minutes standing.

15. Then fill jar half full of water.

16. Hold hand over top of jar and upend jar over a drying pan. Remove hand to allow sand to run into pan. Rinse all the sand grains into the pan.

17. Let stand for 5 minutes.

18. Pour off all the water possible without loss of silt.

19. Dry in oven 212 degrees Fahr. for 1 hour.

20. Weigh sand grains.

21. Express loss in weight in percentage of clay. Example: Weight of sand grains, operation 20 as 240 grams 300—240=60 grams clay. Per cent clay=60/300=20 per cent.

For Base Permeability:

22. Place screen in permeability specimen retainer.

23. Scoop a sufficient amount of sand grains in specimen retainer to give approximately a 2-inch specimen.

24. Place screen on top of sand grains.

25. Ram with 3 drops and obtain permeability. This gives permeability.

26. Mail sand grains to Detroit plant for screen test. Send report on per cent clay and base permeability to operating department.

For Screen Test (Detroit plant):

27. Assemble the screen on bottom pan in order of fineness.

28. Place a 50 gram sample in the top screen. Use scoop in taking this sample and mix well.

29. Place screens in ro-tap and shake for 30 minutes.

30. Weigh the amount of sand grains retained on each screen. Since a 50 gram sample is used, multiply weight in grams retained on each screen by two and express fineness in percentage.

31. Record data on form No. 315.

32. Mail data to operating department.

Strength Testing Apparatus

The strength test is used to obtain numerical values showing the comparative bonding qualities of molding sand which determines its ability to hold together. This ability of molding sand to hold together is called the strength of the sand. The A. F. A. sub-committee on molding sand test called the strength of molding sand *cohesiveness* or *bond*. The word strength is preferred due to its simplicity and its present day use in testing other materials, for example, cast iron.

The A. F. A. cohesiveness test employs a molded bar of molding sand 16¾ inches long with a cross section of 1x2 inches. This bar of sand is pulled over an edge until the projecting end breaks off. The portion of the bar which breaks off is weighed in grams. The number of grams is used to designate the cohesiveness or strength of the sand. This method of testing the strength of molding sand is not recommended for our

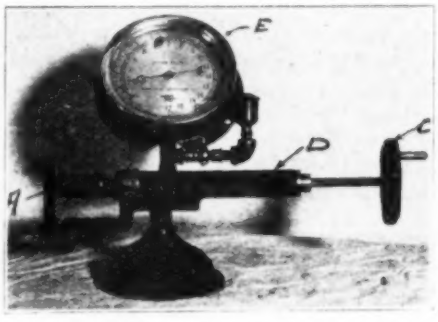


FIG. 5—STRENGTH TESTING MACHINE

plants due to the length of time required to make the test. The strength test as outlined in this report is the most rapid method.

The bonding quality or strength in molding sand whether it be of heap sand or new sand, is one of the most important physical properties. A slight change in the bond of either new sand as shipped or of heap sand readily may be determined by the strength test. Heap sand does not become weak over a single cast but the decrease of strength is gradual. A glance at the strength reading immediately will show the foundrymen whether the heap is losing some of its bond.

The strength machine is so designed that a rammed specimen of sand is loaded with an oil pressure. The stronger the sand the larger the amount of oil pressure required to crush the sand specimen. The amount of the oil pressure is determined by the reading of a pressure gage. Thus the strength of the sand is expressed as two or three pounds as the case may be. The two-pound sand will hold up two pounds per square inch of sand surface.

The rammer for the strength specimen is constructed in accordance with the accompanying illustration shown in Fig. 4. It consists of a steel rod supported by a steel frame. The guides of this steel frame are drilled to give the steel rod a sliding fit. A cast iron head weighing exactly seven pounds, slides on the rod. Stops pinned to the steel rod regulate the movement of this head to 2.56 inches. A mold and a bottom rammer are shown in Fig. 4. The mold for the sand specimen is made of bronze or brass. The bottom rammer is made of steel.

The strength testing machine is shown in Fig. 5. The base and hand wheel of the machine are made of cast iron while the remaining parts of the machine are constructed of steel.

The strength machine consists of a screw plunger mechanism on one end while on the opposite end is a freely lapped piston. The piston should be ground in until a film of oil separates the piston from the body of the machine. A cloth screen is placed around the piston to protect it from the sand. The screw plunger mechanism is used to create an oil pressure. The projecting end of the base under the sand specimen is dropped lower on the late built machines to avoid interference of sand as it accumulates on the arm.

The method of attaching the pressure gage and oil reservoir is shown in Fig. 5. The pressure gage is recalibrated to read one quarter of its oringinal readings. This is readily accomplished by making a new dial of drawing paper.

Preparing the Sample

The sample to be tested should be an average representative of the heap sand, car lot, bank, or whatever source it is taken from. The amount of moisture in the sand influences its strength. Thus the strength reading of the heap sand is affected not only by the amount of bonding substance contained in the sand but also by the amount of moisture with which it is tempered. New sands should be tempered to the dry side and then strength readings taken after each addition of 1 per cent moisture.

To check sand received in car lots the representative sample should be dried in an oven at 212 degrees Fahr. with a tolerance plus or minus 5 degrees. After this sample has cooled the sample is tempered with sufficient amount of water to bring its moisture percentage to that shown on the permeability curve which will give the sand its maximum permeability.

The sand specimen is rammed by a ramming apparatus as shown in Fig. 4. The mold *A* is set over the bottom rammer *B*, the stop pin *C* is used to hold the mold *A* in position on the bottom rammer *B*. Take a sufficient amount of sand to fill the mold. The mold assembly is placed under the rammer *E*. The next operation is to let the rammer assembly rest on the

sand in the mold. Remove the stop pin *C*, Fig. 4. This allows the lower end of the sand specimen to be rammed with the same force as the upper end of the specimen. The ramming weight *F* next is raised to the upper stop *G* (2.56 inches) and let fall. One drop of this weight is required. This gives the specimen the same hardness as the permeability specimen. Note whether the upper end of the rod is within the tolerance marks *H;* if not discard the sample. Should the rod project above the tolerance marks, place the stop pin *Z* in lower hole. If the sand specimen is short, which would be indicated by the ramming rod falling below the tolerance mark, the stop pin *C* is placed in a hole above the original position. In control work the operator soon will determine which hole gives him a sand specimen of the required length.

Removing Sand Specimen

The mold assembly is placed on one side of the rammer base as shown in Fig. 4. Grasp the mold with the right hand and press the mold down. This operation strips the sand specimen free from the mold. Grasp the specimen by the thumb and the index finger of the left hand and blow off each end.

Retain this manner of grip on the sand specimen, *A*, Fig. 5. and place it in the strength machine as noted in Fig. 5. The hand wheel *C* of the oil pump then is turned at the rate of 120 revolutions per minute until the specimen breaks. The turning of this hand wheel drives the plunger into the cylinder *D*, compressing the oil into the system. The oil pressure supported by the sand specimen is registered by the pressure gage *E*. The maximum reading of the gage, or the crushing strength of the sand, is recorded as the *strength*. A single reading is sufficient to determine the strength of a heap sand provided the operator is experienced. However, for a new sand it is desirable to make at least three readings.

The area of the piston head *B*, Fig. 5, is one-quarter of a square inch. Thus every pound per square inch in the system exerts on the piston head, Fig. 5, only one-quarter of a pound. This pressure is supported by the sand specimen *A*. The area of the sand specimen *A* is one square inch so that every pound per square inch in the system *D* exerts one quarter of a pound per square inch on the sand specimen. In other words, a pressure of four pounds per square inch in the oil system of the strength machine exerts a load of one pound per square inch on the specimen. Should a standard gage be used, its readings must be divided by four to give pounds per square inch strength of the sand. To avoid this division a new dial is placed on the gage with calibrations reading to one fourth of the original readings. The testing machines as installed in our sand laboratories are equipped with recalibrated gages and the strength is designated in pounds per square inch by the exact gage readings.

Readers Comment

Note—Material appearing under this head does not necessarily reflect the opinion of The Foundry or of its editors.

Claims Report Contained Misleading Data

To the Editors:

My attention has been directed to an article *Malleable Furnaces Fired with Pulverized Coal,* by Warner Hathaway in the Oct. 15 issue of THE FOUNDRY. This article purports to describe conditions at the plant of the Western Malleables Co., Beaver Dam, Wis., but in some extraordinary manner the tables used to illustrate the article are exact duplicates of others incorporated in a report submitted by an engineer in a malleable iron plant in Indiana; a report dealing with the operation of a pulverized plant sold the company in 1919 by the writer. A paper on the subject was presented at the convention of the American Foundrymen's association held in Rochester, N. Y., in 1922. This paper has been incorporated in the *Transactions* of the association, vol. XXX, 1922 and also was presented in the columns of the *Iron Trade Review* in the May 3, 1923 issue.

Duplication of results within certain limits are within the bounds of possibility, but the exact fidelity with which all the figures in the Hathaway report coincide with the figures dealing with another installation and placed in operation at least three years earlier, automatically discredit their accuracy.

For example under the heading *Power Preparing Coal,* the column of figures is identical with a former column to which I referred, identical to the point of a slight error in the addition. Even if it were possible for two widely separated plants to show a similar itemized column of costs, certainly it is outside the bounds of probability for two accountants to make the same small error in addition.

This article also states that the repair work on the bungs consumed exactly 1008 bricks. This coincides precisely with the number mentioned in the earlier report. Further, the labor charges and the number of heats also are the same. Even the veriest tyro among foundrymen will reject the statement that any two melting furnaces, located in different parts of the country, even though they are of the same capacity, can have the same amount of repairs down to the exact number of bricks.

The Beaver Dam plant was not placed in operation until 1922 and yet conditions were duplicated there so faithfully that even the figures for the year—1919—are the same. In the table showing cost of charge the head reads: *Makeup Charges for the Year* 1919 *Using Hand Fired Compared with* 37 *Heats Using Pulverized Coal Year* 1919. In other words the report apparently deals with the running of a plant two years before it was placed in operation. Under the same heading the saving effected by the substitution of scrap for pig iron is identical to the last digit in the report covering the Indiana plant in 1919 and the Beaver Dam plant of recent date. Marvelous of course, but scarcely credible.

On page 828, second column we read "The amount of coal delivered per revolution of the feed screw is determined by actual test, revolution counters *E* indicating the daily number of revolutions of each screw, thus recording the actual amount of coal used daily in the melting and annealing."

Any person with experience with pulverized coal knows that it cannot be measured accurately from a storage bin by counting the revolutions of the feed screw. Where the storage bin is full of coal or two thirds full the amount of coal flowing through the feed screw per revolution will be entirely different from the amount flowing through when the storage bin is one quarter full or less.

In addition to the insertion of outside tables and data the article in THE FOUNDRY deals with other facts that cannot be substantiated. For example

we read on page 832 near the bottom of the second column "A 25-ton heat can be melted in four hours." This means that a ton of iron can be melted in 9 6/10 minutes. Every foundryman in the country knows this is a physical impossibility with a heat of that size. If you look up the article in the *Iron Trade Review* you will find a record of 16 heats ranging from 12 to 25 tons. The melting time ranged from 4 *hours of the* 12 *ton heat* to 5.6 hours for the 25-ton heat.

C. F. HERINGTON,
Pittsburgh, Pa.

Where's All the Shootin'?

To The Editors

The P. A. and his Victim are entrenched.

Barrage after barrage has gone over. As to the range that is a matter to be decided by the several instruments at the command of each battery. Straight hits can be judged only by the amount of damage done.

Therefore let us take a major premises and follow through.

No individual nor organization can do business without a fair profit and long endure. In line, no individual nor organization can at any time maintain itself intact selling at less than cost. Therefore, competitive selling at a profit necessitates a study of competitive costs. Competitive costs usually proportionate themselves directly with the intelligence of works management, office management and the selection of production machinery.

Works management may be likened to the heart in the human body, supplying the body with a clean flow of blood that the nerves and muscles may do their required work efficiently. Directed by the policies of the organization this department of production bears the greatest responsibility. Production schedules maintained by willing, intelligent workmen under the guidance of foremen may be tremendously expensive. Costs may mount with the finest of organized manpower unless care in selection of machines and the subsequent elimination of man power, is exercised. It is here then, that the works management and office management must cooperate perfectly.

The reduction of costs rests upon ability to produce the same quantities or greater quantities at less expenditure per unit operation. Slow hand methods are replaced by speedy machine methods requiring better operators at higher wages but effecting unit savings which add to a figure much less in the aggregate than that covering hand work alone. Experience in actual practice then recommends machinery which will speed operation without sacrificing quality. Figures show that savings soon will pay the cost of installing labor saving equipment and the increase in the wages of one operator where ten hand workers were required before. Figures also show that upkeep will be so much less than the wages of these extra hand-workers that in a short time actual cost to produce larger quantity will be much less. Here the opportunity to secure more business at lower selling prices and greater volume-profit, immediately presents itself and reorganization of plant conditions takes place.

If competition is keen enough that one sales department can offer necessary materials at a little less per pound, and get the business, does not the burden rest on that organization who loses thereby to analyze its trouble and rectify it? If expensive operation is causing a loss of business will intelligent application of modern equipment not place that organization in the running? Does the organization which forsaw the production problem in the right light and met it squarely with an investment in efficient equipment stand to be criticised if it can get the business at a lower unit price for quality goods? Economic situations govern price scales to a great extent. Therefore, every individual or organization which looks within itself to improvement of methods in producing efficiently and at low cost will be equipping itself indirectly with strong sales fortification.

To manufacturers of foundry equipment designed to produce greater volume at less unit cost, this controversy seems to savor of the days when Volstead was unknown and sales were made under a cloud. Page 937 of THE FOUNDRY for Nov. 15 last paragraph summarizes the condition under which the successful organization operates to a legitimate profit. The advertising section of THE FOUNDRY offers constructive suggestions from reputable firms ready to a man to help the foundrymen to produce castings on a more efficient basis. The marketing process will then adjust itself more to the liking of all concerned.

C. C. MCKINNEY

The use of magnesium as a deoxidizer and desulphurizer continues to broaden. Magnesium also is used as an alloying metal to give additional properties to metals. Aluminum containing about 4 per cent of magnesium possesses electrical properties, containing 0.5 per cent has high strength and a new alloy just developed in 1924 is especially suitable for castings. Lead hardened with 0.4 per cent magnesium is attracting interest as a covering for telegraph and telephone cables.

Book Review

Mainsprings of Men, by Whiting Williams; cloth, 313 pages, 5 x 8 inches; published by Charles Scribner's Sons and furnished by THE FOUNDRY, Cleveland, for $1.50 postpaid, and in Europe by the Penton Publishing Co., Ltd., Caxton House, London, for 7s 6d, net.

The author spent several years working in shipyards, coal mines, steel plants and in other places where semi-skilled labor is employed, both in the United States and Europe, for the purpose of ascertaining the working man's viewpoint of his job and the condition under which he labors. The book is divided into three general parts: What the worker wants; what all of us want; and finding out what we want in our work. Interesting conclusions are drawn and many theories are expounded at length. The fact is stressed, and perhaps overstressed, that the worker cares more about his job and the social prestige that may come from it than he does about the actual amount of money earned.

Another interesting conclusion set forth is that workers can be found for monotonous jobs on repetition work where almost no mental effort is required due to the fact that such employment affords plenty of time for day dreaming. At the conclusion of each of the thirteen chapters is a number of problems put in the form of questions which are more or less theoretical. Taken all together the book makes interesting reading for any man whose attention is occupied by labor problems.

Gun Metal Defined

Question—Is there a grade of cast iron known as gun metal?

Answer—Gun iron is a term applied to the metal melted in the air furnace. This metal has low sulphur content and usually only a small amount of phosphorus. The sulphur generally will be below 0.05 per cent and the phosphorus below 0.2 per cent. Being melted in the air furnace, the total carbon also can be kept below 3 per cent.

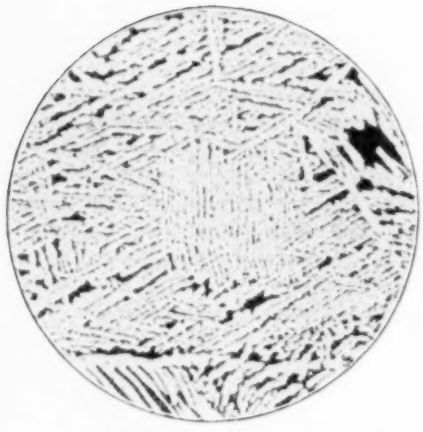


Fig. 1—Standard Brass 59 Cu, 41 Zn

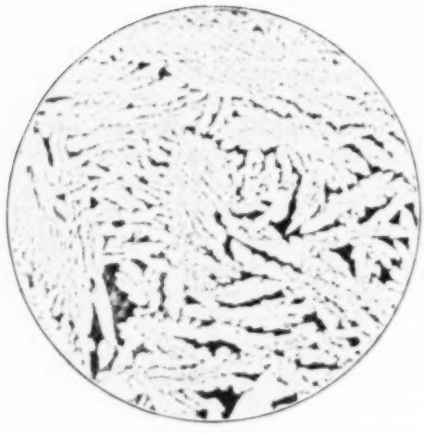


Fig. 2—Nickel Added, 59 Cu, 40 Zn, 1 Ni.

Fig. 3—Nickel Increased 59 Cu, 37 Zn, 4 Ni

Studies Special Nickel Brasses-I

Investigation Reveals Series of Bewildering Alloys—Constant Conditions Maintained Throughout the Research, Thus Eliminating Variables

By Oliver Smalley

EXCEPT for the work of Guillet, who conducted a systematic investigation on the zinc replacing value of nickel in brass, and extended his investigation with a view to developing commercial high zinc content nickel brasses, the author does not know of any systematic research on the subject of special nickel brasses. The most promising commercial alloys and their physical properties obtained by Guillet are given in Table II.

These test results scarcely justify the use of such quantities of so expensive a metal, and could have been obtained from ordinary commercial brass. For purposes of comparison, the physical properties of ordinary brasses, ranging from 70 per cent to 50.1 per cent copper in both the cast and normalized conditions are included in Table I. By *normalized condition* is meant the condition that results from mechanical and thermal treatment which completely removes casting structure, internal strain and heterogeneity. The properties incidentally furnish a useful standard of the properties of castings and of rolled, extruded and forged brass when correctly annealed.

A close study of some of the well known special brasses containing nickel reveals a series of alloys which bewilder by their complexity. One can only hazard a guess at the function and commercial value of each of the many elements used. For this reason, it is intended to treat synthetically the development of complex nickel brasses, considering the commoner metals, including nickel, as a third element, proceeding to study nickel as a fourth element on the most promising of the ternary series, as a fifth element on the quaternary series, and so on to the more complex

Nickel Brasses

NUMEROUS advantages result from adding nickel to brass, a variety of alloys being produced by varying the elements producing the mixture. While the nickel added to the brass produces sounder and smoother castings in many cases, the function and commercial value of each of the many elements used may be developed only through tests. In this paper, which was presented at the Syracuse, N. Y. meeting of the Institute of Metals division of the American Institute of Mining and Metallurgical Engineers, Oct. 5-9, the author has treated synthetically the development of complex nickel brasses.

FIG. 4—SUBSTITUTING ALUMINUM FOR ZINC. 59 Cu, 40 Zn, 1 Al

FIG. 5—SUBSTITUTING ALUMINUM FOR COPPER. 59 Cu, 39.5 Zn, 1.5 Al

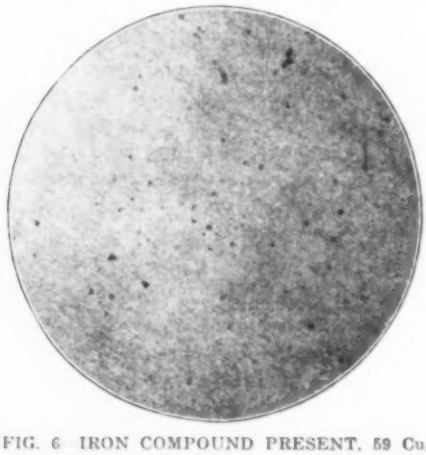


FIG. 6 IRON COMPOUND PRESENT. 59 Cu, 40 Zn, 1.0 Fe

alloys. To this end, constant conditions were maintained throughout the research, eliminating all variables except the one desired; namely chemical composition. For this reason, virgin metal and specially prepared stock alloys of the chemical composition given in Table IV were used.

Melting was performed in a 100 pound pot in a natural draft coke furnace. The method of introducing the various special metals investigated and the precautions necessary will be detailed under each distinctive heading. Each melt was poured into a chill iron mold 2½ inches square, the temperature of which was 130 degrees Fahr. To eliminate the variables introduced by sand molds, the pouring temperature of each alloy was controlled at 10 per cent superheat.

When it was desired to investigate in the forged or heat-treated conditions, the lower half of the ingot was forged into 1-inch square bars. In the case of cold working alloys, a 100-pound ingot was cast 1.05 by 4 inches wide. The lower half was cold rolled in three passes to 0.55-inch, annealed at the correct temperature, reduced to 0.45-inches and reannealed so as to restore to the orginal cast brinell hardness number before testing.

Tensile tests were prepared in accordance with the specification of the Engineering Standards committee, the area being 0.25 square inch and gage length 2 inches. A permanent set of 0.01 inch is recorded as yield point. Hardness was determined by the brinell ball test and the shore scleroscope; the former being made with a 10-millimeter ball under a pressure of 1000 kilograms maintained for exactly 30 seconds, while the latter test was made with a soft hammer.

In the dynamic stress tests both alternating and single-blow impact tests were made where possible. In the former, the test piece used was 4 by ½ by ½ inch with a 1/16-inch radius groove milled in the center of one face at right angles to the principal axis. A steel tup having a total weight of 10 pounds was allowed to fall from a height of 18 inches on to the test piece, the first blow being given on the face opposite to the groove, and for every succeeding blow, the test piece rotated through an angle of 180 degrees. The blows were delivered at a regular rate of 25 per minute, and the number required to break the test piece completely was recorded as the alternating impact number. The single blow impact test piece was made in the Izod machine, using the standard 10-millimeter square test piece, notched 2 millimeter deep at an angle of 45 degrees and the striking hammer contacting the test piece at a distance of 22 millimeters above the bottom of

Table II

Results Obtained by Guillet

Copper	Zinc	Nickel	Maximum Stress, Tons Per Sq. In.	Elongation, Per Cent.	Reduction of Area, Per Cent.	Brinell	
55.0	41.0	5.0	24.4	46.5		94	Sand cast.
			22.6	27.0		90	Chill cast.
56.7	39.74	3.35	30.0	43.0	51.7	97	Casting annealed 2 hr. at 750° C.
			33.9	33.0	50.7	144	Cold-drawn bar.
55.15	42.3	2.24	29.8	33.0		116	Casting annealed 2 hr. at 750° C.
			32.3	29.0		151	Cold-drawn bar.

Table I

Physical Properties of Pure Brass

Composition		Condition	Yield Point, Tons per Sq. In.	Maximum Stress, Tons per Sq. In.	Elongation, Per Cent. in 2 In.	Reduction of Area, Per Cent.	Alternating Impact Number	Brinell Hardness Number	Scleroscope Hardness Number
Copper, Per Cent.	Zinc, Per Cent.								
70.0	30.0	As cast	6.50	16.70	58.00	57.00	79	55	15
		As forged and annealed	8.00	21.50	68.00	65.00	85	57	15
59.0	41.0	As cast	8.80	24.90	45.00	49.70	79	90	14
		As forged	9.00	26.00	47.00	62.00	87	90	14
		Forged and annealed 650° C. for 1 hr.	7.00	24.00	49.00	55.00		79	12
53.3	46.7	As cast	9.00	29.70	24.00	21.50	34	108	18
		As forged	9.70	32.80	28.00	30.60	49	114	18
		Forged and annealed 650° C. for 1 hr.	7.50	29.10	22.50	31.60		108	18
51.2	48.8	As cast	7.20	26.90	19.00	21.50	27	108	18
		As forged	9.20	33.40	37.00	33.50	36	114	18
		Forged and annealed 650° C. for 1 hr.	5.30	29.00	25.00	27.00		108	18
50.19	49.81	As cast	6.00	8.80	1.00	1.50	1	108	18
		As forged	2.30	15.80	5.00	5.50	9	117	19

Table III

Special Brasses Containing Nickel

Name	Cu	Zn	Ni	Al	Mn	Fe	Sn	P	Pb	
Turbadium bronze	48.0	46.45	2.0	0.20	1.75	1.00	0.50	0.10		
Turbiston bronze	55.0	41.00	2 0	1.00	0.16	0.86		Nil		
German periscope. Maclean Institute of metals, 1921—1	53.0	34.00	9.0	0.35	1.50	1.50				
Maclean Institute of Metals, 1921—1	60.0	34.0	3.0		0.50	2.00	Phosphortin 0.25		0.25	Warranted to give 30 tons tensile with appreciable elongation.
Hirst Institute of Metals, 1921—1	54.93	38.41	2.59	0.93		1.93	0.19		0.96	
Nickel-manganese bronze	53.4	39.0	2.5	0.20	1.70	0.30	2.60		0.30	

FIG. 7—REFINING EFFECT OF IRON, 59 Cu, 40 Zn, 1.0 Fe

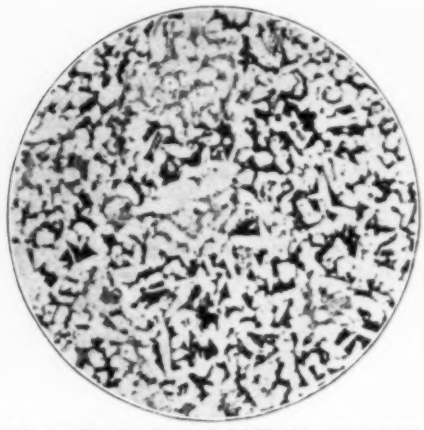


FIG. 8—GRAIN IS NOT REFINED FURTHER. 59 Cu, 39.5 Zn, 1.5 Fe ETCHED

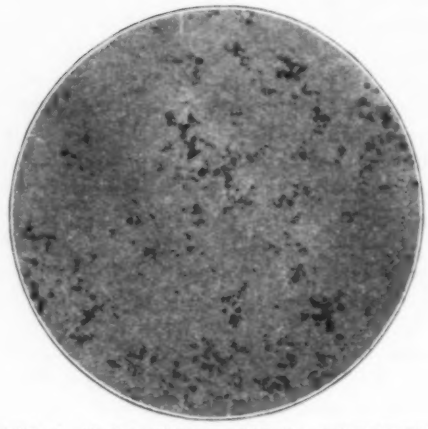


FIG. 9—59 Cu, 38.5 Zn, 2.50 Fe, UNETCHED

Table IV

Chemical Composition of Metal Used

Material	Cu	O$_2$	Zn	Ni	Co	Pb	Fe	Al	Si	Sn	Cd	Mn	As
Copper, American electrolytic	99.81	0.19		Nil		Nil	Trace						
Zinc	Nil		99.99			Trace	Trace		Trace		Trace		
Cupro-nickel	92.58			72.5			Trace						
Cupro-cobalt	90.00			0.04	9.76		0.20						
Ferro-copper	90.00						10.00						
Ferro-zinc	0.29		94.10			1.16	4.45						
Aluminum	Trace						0.40	99.51	0.09				
Tin	Nil		Nil			0.20	Nil	Nil		99.70			0.10
Cupro-manganese	72.73					0.09	2.36		0.30				
Phosphorus											0.03	24.35	

the notch in the standard test piece.

Nickel Brass—According to the equilibrium diagram prepared by Guertler and Tammann, nickel alloys with copper in all proportions form a perfect isomorphous mixture, while the resulting series of alloys, which possess specially useful properties, justify their somewhat high cost. The amount of nickel that zinc will take into solution is so small that it is questionable whether it is soluble at all, although nickel forms a solid solution with up to approximately 50 per cent zinc.

Functioning as a copper replacing element, the alloying property of nickel with the ordinary brasses is similar to that with copper. To introduce pure nickel, a nickel-copper or nickel-zinc stock alloy may be used. Details of composition and test results of the first series of alloys made are given in Table V.

As Cast—With a constant copper content and reducing the zinc content by the added nickel, 1 per cent nickel

Table V

Effect of Nickel on Brass

Series No.	Intended Composition: Copper, Per Cent.	Intended Composition: Zinc, Per Cent	Intended Composition: Nickel, Per Cent.	Actual Composition: Copper, Per Cent.	Actual Composition: Zinc, Per Cent.	Actual Composition: Nickel, Per Cent	Physical Condition	Yield Point, Tons per Square Inch	Maximum Stress, Tons per Square Inch	Elongation, Per Cent in 2 Inches	Reduction of Area, Per Cent	Fracture	Alternating Impact Number	Fracture	Brinell Hardness Number	Sclerescope Hardness Number	Special Comment
N	59.0	41.0	Nil.	58.96	41.04	Nil.	As cast	8.80	24.9	45.0	49.7	Fine, stony, semi-cup and cone	79	Fine granular, silky edges	90	14	
							As forged	9.00	26.00	47.5	62.00	Fine, stony, silky, edges	87	Fine granular, silky edges	90	14	
N$_1$	59.0	40.0	1.0	58.68	40.4	0.92	As cast	9.0	21.1	23.0	36.4	Fine, stony, hackly	77	Fine granular slightly vitreous in upper half	76	13	
							As forged	11.0	26.5	49.0	59.3	Fine, silky, uneven					
N$_2$	59.0	39.0	2.0	59.0	39.10	1.90	As cast	9.0	23.7	56.0	49.7	Fine, stony, semi-cup and cone	93	Fine granular slightly vitreous in upper half	69	11	
							As forged	11.9	26.2	54.0	68.0	Fine, silky, uneven	125	Fine, stony, vitreous	90	13	
N$_3$	59.0	37.0	4.0	59.02	36.95	4.03	As cast	6.9	18.3	50.0	52.2	Fine, stony, semi-cup and cone	135	Fine granular highly vitreous	57	9	
							As forged	9.9	25.0	64.0	70.0	Fine, silky, cup and cone	144	Fine, stony, vitreous	74	10	

PRACTICAL SANDBLASTING

By J. M. Betton

Sandblasts may be obtained in sizes ranging from 60 to 4000 pounds capacity of sand, the quantity not interfering with the effect, the smallest size being as effective as the larger, but requiring refilling more often.

Sandblasts are of one of the following types; gravity, suction and pressure. Good work may be obtained by using a nozzle ¼ or ⅜ inch diameter under an air pressure from 25 to 75 pounds, depending upon the material to be cleaned. Steel castings take higher pressures.

The quantity of air used depends upon the air pressure and diameter of the nozzle. No more air can be used than will be passed through the nozzle regardless of the diameter of the air inlet. The quantity of air used will increase rapidly as the diameter of nozzle and the pressure are increased, emphasizing the necessity of watching the wear of the nozzle and replacing it at intervals.

The quantity of air and consumption of power are shown in the accompanying table.

Regulate the flow of sand so that just enough is delivered to give a quick and thorough cleaning, which is effected by permitting each grain of the abrasive to strike the surface without interfering with its neighbors. When the sand can be seen issuing from the nozzle, the feed will be about right. Hold the nozzle about 6 inches from the work and at an angle of 30 to 45 degrees.

The air compressor may be of any standard make capable of delivering the required quantity of air. It will be found advantageous if the compressor is capable of furnishing additional air for other shop purposes.

Use as large an air receiver as possible and connect it to the sandblast with piping of ample size, short and direct. If the distance is more than 75 feet, increase the diameter of the connecting pipe one size. The air piping must be kept tight and free from leaks. Protect it from the cold to lessen the condensation which should be removed by a moisture separator located near the sandblast.

Use an abrasive sand such as silica sand, flint shot or a metallic abrasive such as crushed steel or steel shot. Steel abrasive should be kept dry as it may rust and form pellets or balls if exposed to moisture.

Do not kink or bend the hose, if a hose sandblast be used. It will cause the hose to wear out where bent and will waste both air and power necessary to remove the accumulation of sand that will collect in the hose.

(*Concluded on Data Sheet No. 604*)

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

THE FOUNDRY DATA SHEET, JAN. 1, 1926
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

PRACTICAL SANDBLASTING

(*Concluded from Data Sheet No. 603*)

Change the nozzle frequently. All nozzles will wear regardless of the material from which they are made, causing increase in air consumption, often exceeding the capacity of the air compressor.

The sandblast room should be simple in construction. The room is lighted best by electricity with the lights located on the sides and protected from the flying sand by wire screens. The cleaning room should be located in direct line of the natural flow of the castings from foundry floor to the shipping room.

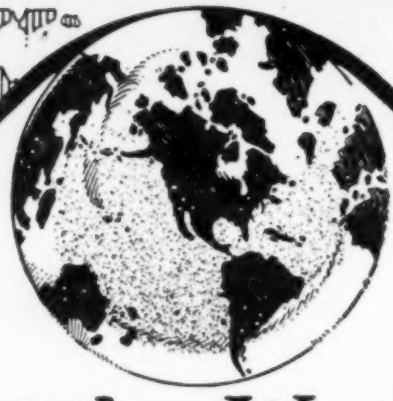
Make the sandblasting a department, giving it due credit for prompt, quick and clean work. Give it attention and keep it up to the standard.

CUBIC FEET OF FREE AIR DISCHARGED PER MINUTE BY SAND BLAST NOZZLES, WITH HORSEPOWER REQUIRED FOR OPERATION—20 PER CENT ADDED FOR FRICTION

Single Stage Compression at Sea Level

Diam. nozzle, inches.		Gage pressure, pounds											
		25	30	35	40	45	50	60	70	80	90	100	125
3/16	*	8.6	10.0	11.2	12.2	13.4	14.5	16.8	19.0	21.2	23	25	31
	†	0.7	1.0	1.2	1.5	1.7	2.0	2.7	3.3	4.0	4	5	7
1/4	*	19.4	22.4	25.0	27.4	30.4	32.8	37.5	42.9	47.5	52	58	70
	†	1.7	2.2	2.8	3.4	4.0	4.6	6.0	7.5	9.0	10	12	17
5/16	*	34.5	40.0	44.7	49.0	53.8	58.2	67.0	76.0	85.0	94	103	125
	†	3.0	4.0	5.0	6.3	7.1	8.3	10.7	13.4	16.2	19	22	31
3/8	*	54.0	63.0	70.0	76.7	84.0	91.0	105.0	119.0	132.5	147	161	196
	†	4.8	6.4	7.9	9.5	11.2	13.0	16.9	21.0	25.3	30	35	49
7/16	*	77.0	90.0	100.0	110.5	121.0	130.0	151.0	171.0	191.0	211	231	282
	†	6.9	9.1	11.3	13.6	16.2	18.6	24.3	30.0	36.5	43	50	71
1/2	*	138.0	161.0	179.0	196.4	215.0	232.0	268.0	304.0	340.0	376	412	502
	†	12.2	16.3	20.1	24.2	28.7	33.1	43.1	54.0	65.0	77	90	127
9/16	*	216.0	252.0	280.0	307.0	336.0	364.0	420.0	476.0	532.0	587	645	785
	†	19.2	25.6	31.7	37.9	44.9	52.0	68.1	84.0	101.7	120	140	198
5/8	*	310.0	362.0	400.0	441.8	482.0	522.0	604.0	685.0	765.0	843	925	1,127
	†	27.6	36.7	45.2	34.6	64.4	74.7	97.2	121.0	146.4	173	202	284
3/4	*	422.0	493.0	550.0	601.3	658.0	710.0	823.0	930.0	1,004.0	1,145	1,260	1,361
	†	37.6	50.0	62.1	75.5	89.0	101.4	132.0	164.0	192.0	234	274	343
1	*	550.0	645.0	715.0	785.4	860.0	930.0	1,070.0	1,215.0	1,360.0	1,500	1,648	2,000
	†	50.0	65.5	80.8	102.0	115.0	132.8	172.0	215.0	260.0	308	359	504

†Horsepower.
*Free air.



Around the World with The Foundry

Little Journeys to the homes of our readers

Ireland

FOLK LORE, myth and legend, hoary with age and tradition, trace the story of Ireland's history down the dim vistas of time until the thin gossamer threads are dissipated in the mists of antiquity. Swarthy Phoenicians and Greeks, blonde and stalwart Vikings, Normans from France and survivors from the wrecked galleons of the ill fated Spanish Armada, all at various times and in varying numbers landed in the country and contributed their share to the evolution of a people exhibiting in some respects traces of the contradictory characteristics of all these ancestors.

Essentially an agricultural country, manufacturing has been developed to a considerable extent. The great ship yards of Harlan & Wolfe in Belfast have turned out some of the largest liners afloat. Iron and steel fabrication is carried on extensively in several other large industrial centers, including Dublin on the east and Cork on the south.

The foundries generally are progressive and up-to-date and supplied with modern labor saving equipment. THE FOUNDRY with its twice a month symposium of editorial technical description of progress in the casting field and its classified pages of manufacturers of equipment and supplies is consulted regularly twice a month by men interested in the management of 20 out of the 64 prominent foundries in Ireland.

"Wherever metals are cast you'll find THE FOUNDRY"

Table VI

Effect of Aluminum

Series No.	Intended Composition: Copper, Per Cent.	Zinc, Per Cent.	Aluminum Per Cent	Actual Composition: Copper, Per Cent	Zinc, Per Cent.	Aluminum, Per Cent.	Iron, Per Cent.	Lead Per Cent	Physical Condition	Yield Point, Tons per Square Inch	Maximum Stress, Tons per Square Inch	Elongation, Per Cent. in 2 inches	Reduction of Area, Per Cent.	Fracture	Alternating Impact Number	Fracture	Izod Impact Number	Brinell Hardness Number	Scleroscope Hardness Number
A	59 0	41 0	Nil	58 96	41 04	Nil			As cast	8 80	24 90	45 0	49 7	Fine, stony, semi-cup and cone	79	Fine, granular, silky edges		90	14
									As forged	9 00	26 00	47 5	62 0	Fine, stony, silky edges	87	Fine, granular, silky edges		90	14
A_1	59 0	40 0	1 0	59 48	39 52	1 00			As cast	14 8	32 0	30 0	33 5	Coarse, stony and acicular. Trace of intercrystallinity along 2 in. parallel	46	Fine, stony, vitreous	40	114	21
									As forged	11 1	31 3	41 0	41 6	Fine, stony. Free from intercrystallinity	57	Fine, stony, semi-morphous	41	104	18
A_2	59 0	39 5	1 5	58 35	40 11	1 54			As cast	16 4	35 2	17 0	18 5	Between 12 and 14	23	Coarse, crystalline, stony		129	21
A_3	59 0	39 0	2 0	58 26	38 56	2 18			As cast	16 0	36 4	16 0	21 5	As A_3 except it is not so strongly crystalline or so highly colored	25	Coarse, crystalline, stony		138	22
									As forged	11 7	37 4	27 0	33 5	Similar to A_3 but more crystalline	39	Coarsely crystalline strongly laminated		143	23
A_4	59 0	38 0	3.0	59 85	37 13	3 02			As cast	22.3	42.0	18.5	21.5	As A_3	27			159	25
									As forged	19 0	40 3	24 5	30 6	Highly crystalline. Brilliant red luster. Slight intercrystallinity along 2 in. parallel	41	Fine, stony, inclined to exhibit intercrystallinity		154	23

Table VII

Effect of Tin on Brass

Series No.	Intended Composition: Copper, Per cent.	Zinc, Per Cent.	Tin, Per Cent	Actual Composition: Copper, Per Cent.	Zinc, Per Cent.	Tin, Per Cent.	Iron, Per Cent.	Physical Condition	Yield Point, Tons per Square Inch	Maximum Stress, Tons per Square Inch	Elongation, Per Cent. in 2 Inches	Reduction of Area, Per Cent.	Fracture	Alternating Impact Number	Fracture	Brinell Hardness Number	Scleroscope Hardness Number
S	59 0	41.0	Nil	58.96	41.04	Nil	Nil	As cast	8.80	24.90	45.0	49.70	Fine, stony, semi-cup and cone	79	Fine, granular, silky edges	90	14
								As forged	9.00	26.00	47.5	62.00	Fine, stony, silky edges	87	Fine, granular, silky edges	90	14
S_1	59.0	40.5	0.5	59.95	39.38	0.47	0.20	As cast	11.0	26.2	44.0	42.0	Fine, stony, silky edges. More or less hackly	77	Fine, silky, semi-vitreous	87	13
								As forged	15.6	28.8	38.0	60.0	Fine, granular, silky edges. Cup and cone	113	Fine, granular, semi-vitreous in upper half	107	15
S_2	59.0	40.0	1.0	58.90	40.10	1.00	Trace	As cast	9.6	26.7	32.0	33.5	Fine, stony, silky edges. Trace crystallinity existing as exhibited by S_2	47	Fine, crystalline with a slight appearance of laminated crystals exhibited by S_2	98	15
								As forged	13.6	28.6	38.0	44.6	Fine, granular, silky edges. Semi-cup and cone	107	Fine, granular, semi-vitreous in upper half	107	16
S_3	59.0	39.0	2.0	58.82	38.76	2 11	0.31	As cast	11.8	26 1	13.0	15.0	Short, coarsely crystalline consisting of grayish, stony crystals existing alternately	5	Short, grossly coarse laminated crystals	114	20
S_4	59.0	38.0	3.0	59.17	37.63	2.98	0 22	As cast	16.4	21.25	1.5	3.2	Coarse, gray and stony colored. Highly crystalline	1	Short, coarse, laminated crystals	136	23

Table VIII

Effect of Iron on 59:41 Brass

Series No.	Composition				Physical Condition	Yield Point, Tons per Square Inch	Maximum Stress, Tons per Square Inch	Elongation, Per Cent. in 2 Inches	Reduction of Area, Per Cent.	Fracture	Alternating Impact Number	Fracture	Brinell Hardness Number	Scleroscope Hardness Number
	Copper, Per Cent.	Zinc, Per Cent.	Iron, Per Cent.	Lead, Per Cent.										
1F	58.96	41.04			As cast	8.80	24.90	45.00	49.70	Fine, stony, semi-cup and cone	79	Fine, granular, silky edges	90	14
					As forged	9.00	26.00	47.50	62.00	Fine, stony, silky edges	87	Fine, granular, silky edges	90	14
$1F_1$	59.37	39.68	0.95	Nil	As cast	9.40	26.80	44.00	44.60	Fine, silky semi-cup and cone	95	Fine, silky semi-vitreous	90	13
					As forged	13.90	28.80	44.00	63.70	Fine granular cup and cone. Silky edges	81	Fine, stony semi-vitreous	107	14
$1F_2$	59.04	38.95	1.56	0.45	As cast	11.00	26.80	33.60	30.60	Fine, stony granular semi-cup and cone	31	Fine, stony	85	13
					As forged	13.60	27.60	43.00	59.30	Fine granular cup and cone, silky edges	49	Fine, stony, inclined to be vitreous	98	15
$1F_3$	59.12	38.36	2.52	Nil	As cast	10.00	26.50	46.00	49.70	Fine, silky, semi-cup and cone	71	Fine, slightly more silky in appearance than F_1.	92	14
					As forged	15.80	28.30	39.00	54.60	Stony, granular, uneven	79	Fine, stony, semi-vitreous	110	16

brass shows a slight increase in the yield point, a drop in tensile strength, a decrease in the elongation percentage, but little change in the shock resisting properties. Exceeding 1 per cent nickel, there is a general improvement, while the ductility is distinctly superior to that obtained from standard 59:41 brass. Increasing the nickel to 4 per cent reduces both the strength and the elongation per cent without affecting the ductility. As the nickel content increases, there is a general decline in the hardness number.

Forged—Nickel acting as a copper replacing rather than zinc replacing element, quantities up to 4 per cent do not affect materially the hot-working properties of ordinary alpha-beta brasses, although alloy N_3 also works admirably cold. The principal features of the test results of alloys N_1, N_2 and N_3 after forging is their general similarity, although the beneficial effect of nickel on the shock-resisting properties is marked.

Under the microscope, nickel is shown to refine not only the crystal grain and reduce the quantity of beta constituent, owing to a copper-replacing value of approximately 1.30, but to break down the cell walls of the

Table IX

Effect of Iron on 53:47 Brass

Mark	Actual Composition				Physical Condition	Yield Point, Tons per Square Inch	Maximum Stress, Tons per Square Inch	Elongation, Per Cent. in 2 Inches	Reduction of Area, Per Cent.	Fracture	Alternating Impact Number	Brinell Hardness Number	Scleroscope Hardness Number	Number of Crystal Grains per Square Centimeter
	Copper, Per Cent.	Zinc, Per Cent.	Iron, Per Cent.	Lead, Per Cent.										
2F	53.41	46.59	Nil.	Nil.	As cast	9.00	29.70	24.00	21.50	Coarse, crystalline, exhibiting brilljant luster	34	114	15	39
					As forged	8.70	32.80	28.00	30.60	Coarse flasky, exhibiting brilliant yellow crystalline facets, extension uniform over the 2 in. parallel	49	114	15	488
$2F_1$	51.72	47.23	1.05	Nil.	As cast	8.00	30.90	16.00	15.00	Fine, crystalline, exhibiting brilliant crystal facets	9	114	15	1765
					As forged	9.60	33.00	38.00	33.50	Flaky, uneven	39	114	15	2336
$2F_2$	50.77	47.03	2.20	Nil.	As cast	11.10	33.00	17.00	15.00	Fine, crystalline exhibiting brilliant crystal facets	9	114	17	2314
					As forged	8.60	30.60	43.00	44.60	Fine, yellow, almost granular	85	121	17	2200

primary crystal grains; shown in Figs. 1, 2 and 3, representing the standard 59:41 brass, 59:41 + 1 per cent nickel and 59:41 + 4 per cent nickel. These structural changes no doubt, together with the increased toughness of the alpha constituent, explain the improved shock resisting properties obtained.

Aluminum Brass—As the effect of 1 per cent aluminum is equal to 5.6 per cent zinc on both the structure and general physical properties of brass, its influence is directly opposite to that of nickel. The effect of 1.0 per cent, 1.5 per cent, 2.0 per cent and 3.0 per cent aluminum on the mechanical properties of 59:41 brass in both the cast and forged conditions are embodied in Table VI.

Castings—Prominence is given to the remarkable effect of small quantities of aluminum in increasing the yield point and strength, which is accompanied by a corresponding fall in ductility and shock resisting properties. The rapid strengthening limit of aluminum seems to be 1.35 per cent, although maximum strength is not reached until 3 per cent has been added. Exceeding 3 per cent, the strength falls away and on the visible inception of the gamma constituent, the alloy loses its ductility.

Forged—The ordinary alpha-beta aluminum brasses do not present any difficulty in working and readily may be forged, rolled or extruded. However, their increased hardness, demands a relatively greater blow or pressure; and readily hardening up, cannot be worked down to small sections with the ease of muntz metal. All beta aluminum brasses suffer from a long period of heat fragility, regardless of their chemical composition. However, there is no difficulty in working hot, although the range of temperature permissable is limited. Ordinary beta brasses of the copper-zinc series have a period of heat fragility extending from 315 to 455 degrees Cent.; beta brasses of the copper-zinc-aluminum series, approximately from 226 to 558 degrees Cent.

In the beta alloys under consideration forging was performed between 700 and 620 degrees Cent. They may be worked at temperatures above 700 degrees Cent. but there is great danger in doing so owing to the abnormally rapid crystal growth at such temperatures, which is not readily eliminated by a continuance of the work at lower temperatures as obtains in alloys having a duplex structure. At the best, high-tenacity beta brasses are brittle alloys, and slight overheating will render them unsafe.

The effect of forging is shown to have reduced the yield point, to have affected the strength and hardness little, and to have improved both the ductility and shock resisting powers.

Figs. 4 and 5 show the effect of substituting 1.0 per cent and 1.5 per cent aluminum for the same amount of zinc in a 59 per cent copper brass. They demonstrate the coefficient of equivalence referred to and explain the hardening propensities of aluminum.

Tin Brass—In complex high strength brasses where ductility is of importance, 0.75 per cent is the maximum quantity of tin that may be used. In naval brass, 1.0 per cent tin seems to be the useful limit. The constitution of this series has been closely

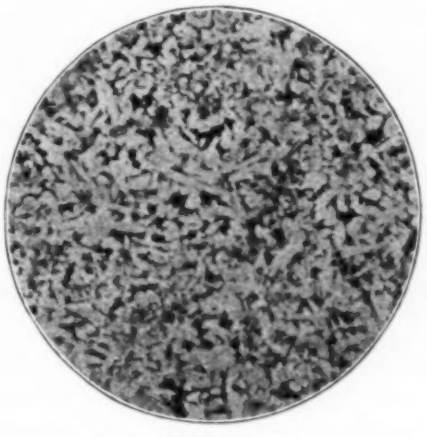


FIG. 10—59 Cu, 38.5 Zn, 1.50 Fe, ETCHED

studied by Hudson, Carpenter, Hoyt, Turner, and others.

The standard 59:41 brass will take into solution approximately 1.0 per cent tin when sand cast and 1.2 per cent when chill cast. With an increasing zinc content, the figure is increased to a maximum of 1.8 per cent at 47 per cent zinc. It is proposed to consider 0.50 per cent, 1.0 per cent, 2.0 per cent and 3.0 per cent tin brasses with 59 per cent copper base. Conditions of manufacture were those outlined for the nickel and aluminum brasses, introducing the zinc and the tin, as such, last. Physical test results are given in Table VII.

Cast—One-half per cent tin increases the yield point and maximum stress 2.25 and 1.3 tons respectively without affecting the elongation, reduction of area and alternating impact strength. Increasing to 1.0 per cent hardens without strengthening and impairs both ductility and impact strength. This embrittlement is accentuated by additional quantities of tin, as shown by alloys S_2 and S_3, the latter having little strength and no ductility.

Forging—No difficulties were encountered in the forging of alloys S_1 and S_2, which worked with the ease of muntz metal. The test results of alloys S_3 and S_4 in the *cast* condition did not justify consideration in the forged condition and no improvement could be obtained by special heat treatment. After forging, the yield point of alloy S_1 is raised 6.6 tons per square inch and the maximum stress, 28 tons per square inch, but the elongation per cent is reduced slightly. However, the drop in ductility is not of real importance, the alternating impact figure being increased no less than 15 per cent. While the physical properties of the 1 per cent tin brass in the cast state are inferior to those of 59:41, they are superior after forging, but it is clearly demonstrated that 1 per cent is the limit of practical utility.

There is little perceptible difference in the structure of an alpha-beta brass containing 0.5 per cent tin and that containing 100 per cent. Exceeding 1 per cent, a brittle copper-tin compound makes its appearance. The effect of this constituent is similar to the "gamma" compound in ordinary brass.

These results show clearly that tin cannot be regarded in the same light as either nickel or aluminum, as it is neither a copper nor a zinc replacing element, although, structurally, attempts have been made to consider it a zinc replacing element, giving to it a coefficient of equivalence of 2.

Iron Brass—Copper and iron form a heterogeneous series of alloys except at the terminals of the curves. Between these proportions the alloys consist of two constituents; the one rich in iron, the other rich in copper. Carbon and copper do not associate in any form and the presence of carbon in iron reduces the solubility to an extent that neither steel nor cast iron can be alloyed satisfactorily with copper, but merely exist side by side as a mechanical mixture. Zinc readily unites with iron.

The effect of iron on ordinary brass has been studied by F. Johnson, Comstock, Guillet, and Millington and the available data place our knowledge of iron brasses on a secure foundation.

In this series the iron was introduced by a 10 per cent iron, copper-iron alloy which was melted alongside with copper except in the case of alloy $1F_2$, when the iron was introduced by a zinc-iron stock alloy. Other conditions of manufacture were those adopted throughout the series. No peculiarities or difficulties were encountered in melting or in pouring.

Cast—The effect of 1.0 per cent, 1.5 per cent, and 2.5 per cent iron on the tensile, hardness and impact strength of an alpha-beta brass of 59 per cent copper content is shown in Table VIII. In castings, 1.0 per cent iron improves both the tensile and shock resisting properties. No improvement of strength is gained by exceeding this quantity, while the shock resisting properties tend to fall; particularly is this true in the case of alloy $1F_2$. However, the low ductility of this alloy is accounted for to some extent by the crystalline form of the impurities introduced by the zinc-iron stock alloy used, and is typical of the every-day troubles encountered when the impure stock alloy is used for the purpose of introducing iron.

Forged—Hot working results in an all round improvement of the tenacity of each alloy, having little influence on the ductility, except in the case of alloy $1F_2$, which improvement is as expected.

The outstanding feature is the refining effect of small quantities of iron on the texture. The author's explanation is that each of the finely divided particles of the high melting point iron-rich particles distributed throughout the molten metal acts or tends to act as a nucleus for the germination of a primary crystal grain. The solubility content of these particles is not known, but they are discernible under the microscope only at high magnifications, when the quantity exceeds 0.35 per cent; at 1.0 per cent they are clearly visible at ordinary magnifications; above 1.0 per cent they begin to aggregate and become visible to the eye from a polished surface.

Illustrates Refining Effects

Fig. 6 shows the form and quantity of the iron compound present in alloy $1F_1$. Fig. 7 shows the refining effect of this iron compound on the microstructure. Fig. 8, representing alloy $1F_2$ as cast, etched shows that there is no further refining of the grain on increasing the iron content. Figs. 9 and 10 represent alloy $1F_2$ containing 2.50 per cent iron, unetched and etched respectively. Except for the presence of larger quantities of the iron-rich compound, no other structural changes are apparent. Guillet regards iron as a zinc replacing element, 0.90 per cent iron being equal to 1.0 per cent zinc. However, this is erroneous; nor does it function in the same way as any of the other elements previously considered.

In view of the fact that the hardness of pure iron is similar to that of 59:41 brass, its limitations as a hardener or a strengthener will be to ordinary brass containing up to 41 per cent zinc. On the assumption that it is neither a copper- nor a zinc-replacing material, but exerts merely a mechanical effect on the mode of the crystal growth, its common use in high-tenacity brasses, therefore, must be that of a grain refiner or densener. To investigate this, three alloys were made, designated 2F, $2F_1$ and $2F_2$. The first contained 53.3 per cent copper and 46.7 per cent zinc; the second, 51.5 per cent copper, 47.5 per cent zinc and 1 per cent iron; while the last one was made up of 51.0 per cent copper, 47 per cent zinc and 2 per cent iron. The copper and zinc were adjusted so as to bring each to a similar position in the beta phase area of the copper-zinc constitutional diagram, assuming the iron to be without influence.

The chemical composition and physical test results obtained are given in Table IX. These indicate iron to be detrimental to the ductility in the cast state, but beneficial when forged. It will be observed also, that forging lowers the yield point of alloy 2F but raises the maximum stress; that it increases both the yield point and maximum stress of alloy $2F_1$, and lowers both the yield point and maximum stress of alloy $2F_2$, though each was treated similarly and had the same brinell hardness in both the cast and the forged conditions.

The mechanical properties of beta brass being unaffected by normal heat treatment—both tenacity and ductility being similar, no matter what the rate of cooling—the changes responsible for the peculiar test results, which are typical of those obtained from complex beta brasses, must be attributable to one or all of the following causes:

1. Internal molecular changes or structural inversion of the beta constituent.
2. Geometrical outline of the crystal grains.
3. Mode of distribution of the iron-rich constituent.

Actual examination proved that iron renders both the internal and external form of the crystal grain more regular and that this is the principal cause of its embrittling properties in cast brass. Forging, refining and interpenetration of adjacent crystal grains explains the improved ductility wrought by mechanical work.

The effect of the iron-rich particles is unimportant, providing they are uniformly distributed and are in a fine state of division.

Having established the functions of the third element, the effect of nickel on the more complex alloys may now be studied.

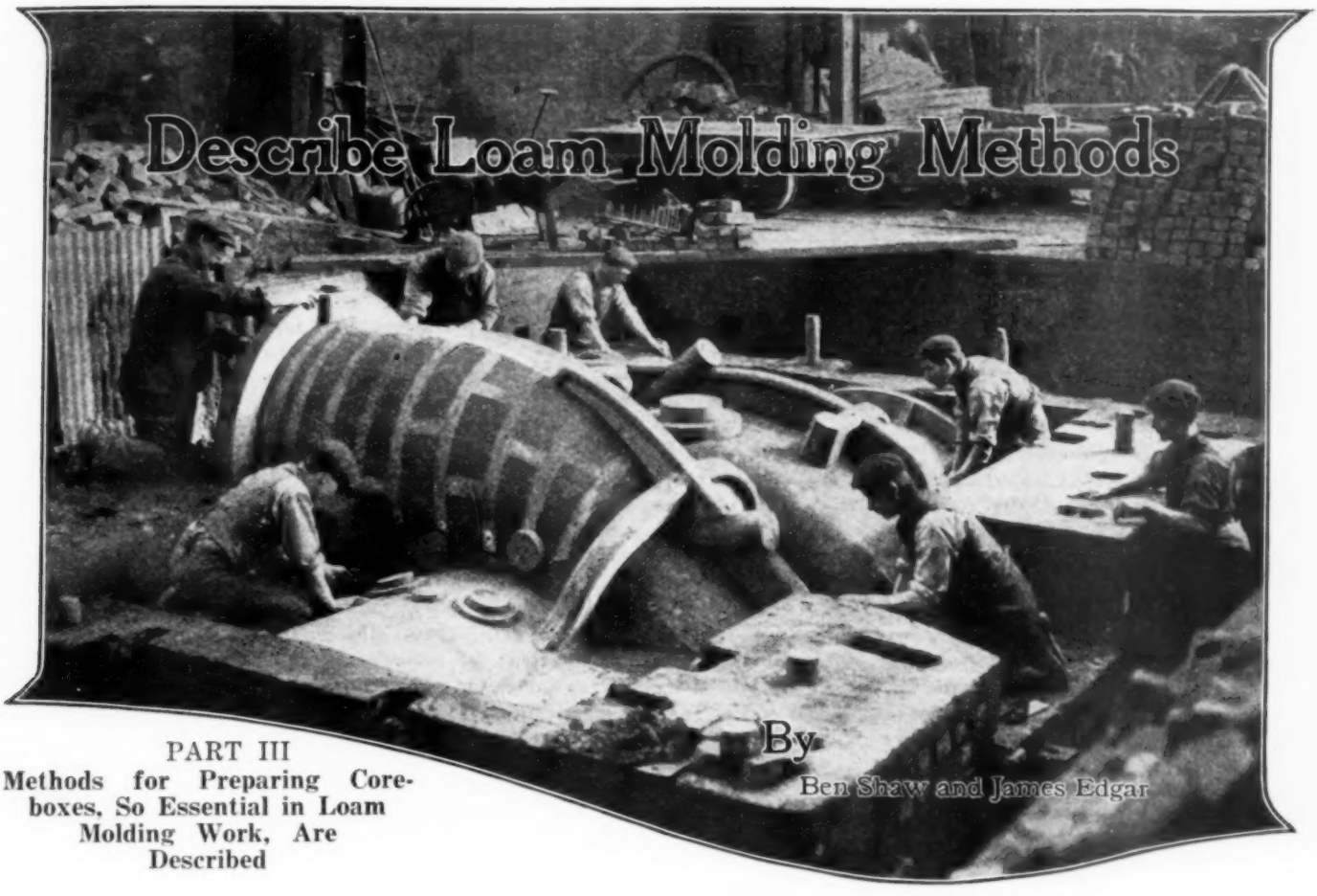
To Overcome Shrinkage

Question: We are making a 3-foot diameter gear blank from a mixture containing 30 per cent pig iron of the following analysis: Silicon 2.65 per cent, sulphur 0.02 per cent, phosphorus 0.88 per cent, manganese 0.64 per cent; 30 per cent charcoal iron showing silicon 2.54 per cent, sulphur 0.01 per cent, phosphorus 0.23 per cent, manganese 0.89 per cent; 25 per cent steel plate clippings and 15 per cent foreign scrap, automobile cylinders, agricultural scrap, etc. We place three risers on the rim and pour the iron through a dry sand basin. Shrinkage holes appear under the risers when they are knocked off in the foundry and further cavities appear after the wheel has been partly machined. Our foreman advises that if we substitute pig iron for the steel scrap the castings will be solid but we are anxious to use the steel on account of the strength it imparts to the mixture.

Answer: Your foreman in this instance is quite correct and unless the cost question is paramount you will avoid a great deal of trouble by following his suggestion. The two pig irons you are using will produce a strong casting, probably stronger than one you could get with steel unless you are thoroughly familiar with its manipulation in the cupola. Under your present conditions the addition of the steel reduces your silicon content in the resulting mixture to approximately 1.60 per cent. If it was not for your exceedingly low sulphur this iron would be too hard to machine profitably in a gear blank. The iron also has a high shrinkage factor. If it really is essential that you use steel you will find it necessary to raise the silicon content in the mixture either by the addition of ferrosilicon or by silvery iron. Further to secure a solid wheel you probably will have to place a generous riser on the rim at the center of each space between the arms.

The Shenango Furnace Co., Sharpsville, Pa., has bought the buildings and equipment of the Josephine foundry of the Valley Mould & Iron Co. at Blacklick, Pa., through Morris Sandow, Sharon scrap dealer. The equipment likely will be removed to Sharpsville and erected there, it is said.

Describe Loam Molding Methods



By
Ben Shaw and James Edgar

PART III

Methods for Preparing Core-boxes, So Essential in Loam Molding Work, Are Described

THE type of cover considered in the previous article is common, but it may be well to explain in detail some of the modifications of practice as applied to boxed covers. By referring to the previous article it will be noted that from a molders viewpoint the cover shown there differs radically from the cover shown in Fig. 14. which has a thickness of metal over the top of the cores.

Obviously an opening is required to each of the pockets for the escape of the gas and afterward for the removal of the sand and core irons, but this feature usually is ignored by the draftsman. Even in shops where castings of this general character form part of the daily routine, the molding detail is left to the discretion of the patternmaker. In some instances the openings through the top plate are tapped and plugged after the casting is cleaned. Where the openings do not interfere with the appearance or usefulness of the casting they receive no further attention.

The core for one of these covers usually is divided into many parts with six as the most popular number. One outlet is essential to each part and on large cores two or more may be required. Short cores which serve the double purpose of lightening the rib and keeping the adjacent cores the proper distance apart are attached either by nails or by setting them in suitable prints. Full patterns sometimes are made for these covers, particularly the smaller sizes, but unless several castings are ordered a loam mold presents the most economical method.

The outer face is cast down and the sweeps required are shown in Fig. 15. The top sweep is made to the shape at the port clearance and a thin piece of wood *A* is screwed on temporarily. Where the sweep is to be used several times it is advisable to reinforce the cutting edge with a strip of thin steel or hoop iron. Loam wears a wood face away rapidly.

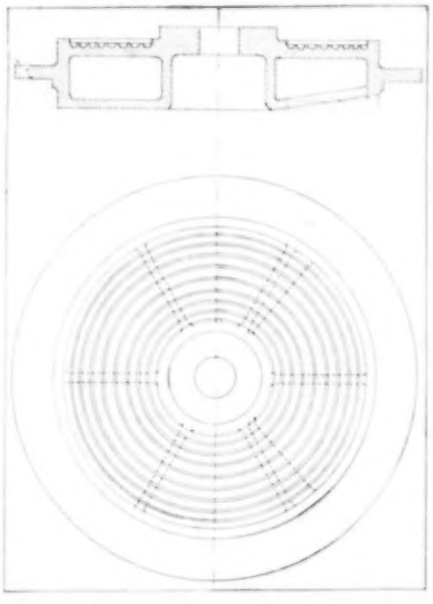


FIG. 14—PLAN AND SECTIONAL VIEW OF A TYPICAL BOXED COVER

An alternative method for attaching the sweep to the spider is shown in Fig. 16. This method frequently is practiced and is reasonably secure. The battens strengthen the sweep and should be attached to all wide sweeps irrespective of the manner in which the sweep is fastened to the spider. Accidents occasionally happen in the foundry and if the lumber has a slight flaw, for example a wind shake, it may crack or split during the sweeping operation. This may be the cause of considerable inconvenience and possibly may interfere with the accuracy of the mold. Battens extending above the top of the board should be at least 1½ inches thick.

Making The Box Cores

The mold for this cover is prepared practically in the same manner as the mold described for the open design of cover. Facing strips are bedded in the loam around the lightening core prints in the bottom face of the mold. These facing strips increase

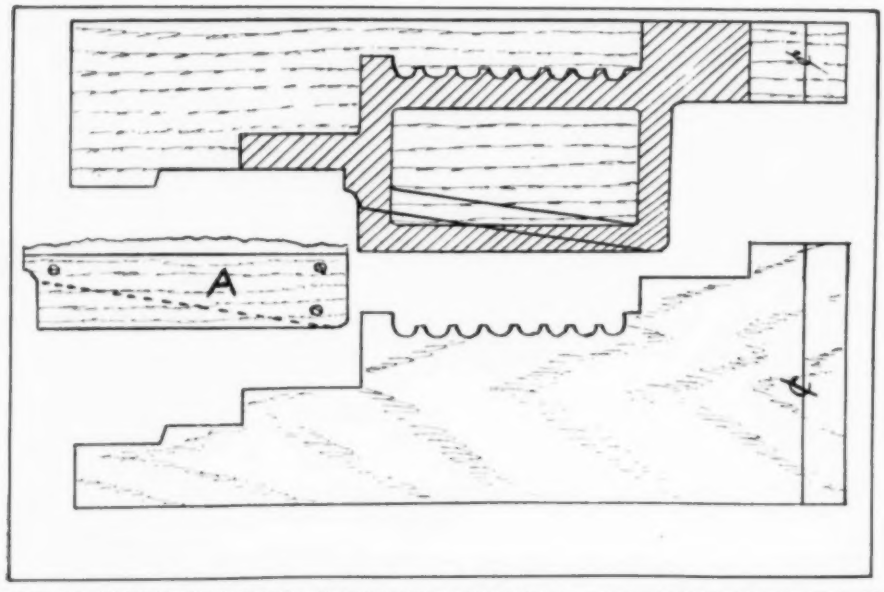


FIG. 15—LOWER AND UPPER SWEEPS FOR THE MOLD. A SECTIONAL VIEW OF THE CASTING IS PAINTED ON THE COPE SWEEP FOR THE INFORMATION OF THE MOLDER

the thickness of metal, reinforce the casting at the weak point, and facilitate subsequent tapping and plugging. Vent pipes are introduced before the mold is built up and the facing strips are bedded in after the sweeping is finished.

Many Methods Employed

The present description is concerned mainly with the box cores. Many methods are used for preparing these cores even where the mold is swept in loam. For purpose of comparison a description of some of the more common methods will be presented. Since the procedure in the foundry is governed by the character of the pattern equipment supplied, reference first will be made to this part of the work.

Many patternmakers favor a sectional corebox in which the required number of cores are made singly. Undoubtedly this type has varied application, but it is not suitable for a boxed cover. The principal objection to the core is that it cannot be balanced properly on the comparatively small vent core on the bottom. The grooved surface of the mold precludes the use of chaplets. The method of making the mold might be reversed to bring the grooved surface on top but that would not improve the situation. The need of chaplets on top is greater than on the bottom. The lift on the core due to the pressure of the metal exceeds the weight of the core. In addition to the difficulty of balancing these cores they are awkward to locate and an excessive number of chaplets will be required on the sides as well as the top to hold them in place while the mold is filling with iron.

Other Coreboxes

Another type of coremaking equipment for a job of this kind is shown in Fig. 17. The core is swept on a rectangular wood plate with a boss for the inside of the core and a strickle for the outside. A piece for the steamway clearance may be shaped and secured to the bottom. The strickle is fitted with a suitable dowel to rotate in a socket. With a core swept in this manner the molder has the opportunity of connecting the cores to form a unit. The steamway clearance piece easily may be removed from the plate and let into the top of the core during the sweeping process, thus obviating the necessity of turning the core over later.

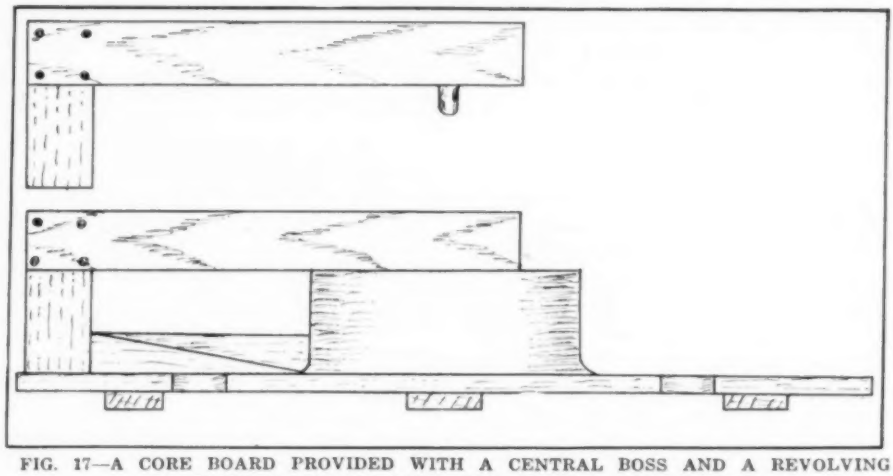


FIG. 17—A CORE BOARD PROVIDED WITH A CENTRAL BOSS AND A REVOLVING STRICKLE MAY BE USED FOR MAKING THE CORES

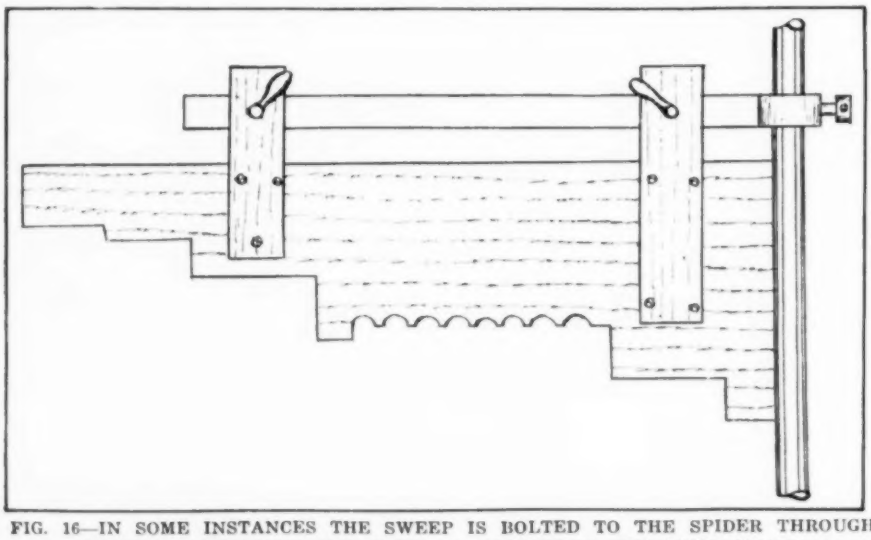


FIG. 16—IN SOME INSTANCES THE SWEEP IS BOLTED TO THE SPIDER THROUGH BATTENS PRIMARILY ATTACHED TO REINFORCE THE WIDE BOARD

Many molders object to this style of coremaking because the cores cannot be handled until after they are dried. Therefore the plate must be placed in the oven and left there until the cores are dried. The result is not always satisfactory since the core warps and twists out of shape.

The minimum amount of pattern equipment needed for a core of this kind includes six ribs, a sweep, a loose piece for the steamway clearance and six core prints for the vent cores. The cores may be swept on a loam bed

and unless the central opening is quite small, no central block will be required.

Two methods are available for preparing cores in this manner. In the first a sweep is employed to form a cavity corresponding to the shape of the desired core. The core then is built in this cavity. In the second method the cores are swept directly on a loam bearing, as shown in Fig. 19. The first method is particularly adapted to cores in which the shape of the bottom is other than flat, but in the present instance the second method is satisfactory. A flat area of the desired size is swept at some convenient point either on the floor or on a plate. Guide lines for setting the ribs and the core prints are laid off in the manner previously described and after these parts are located the grid is bedded down in a thickness of loam. The grid is continuous in that the six units are joined together to form a rigid ring. This form of construction, as previously stated, greatly facilitates handling the core. With six bearings on the bottom the core is balanced securely and only needs chaplets on the top.

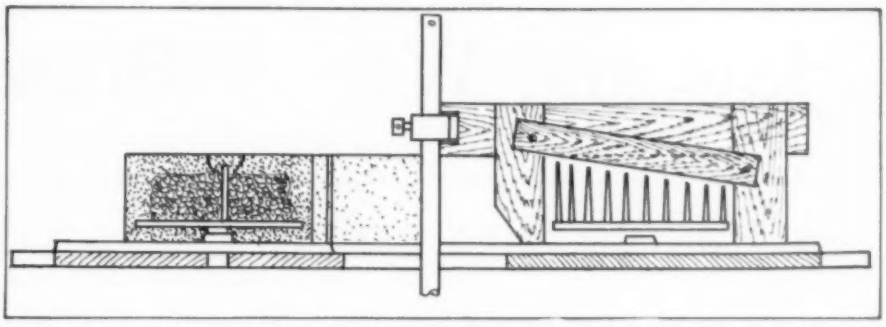


FIG. 19—WHERE A SPARE SPINDLE AND PLATE ARE AVAILABLE THE CORES ARE BUILT UP ON A FLAT LOAM FACE PREVIOUSLY SWEPT ON THE PLATE

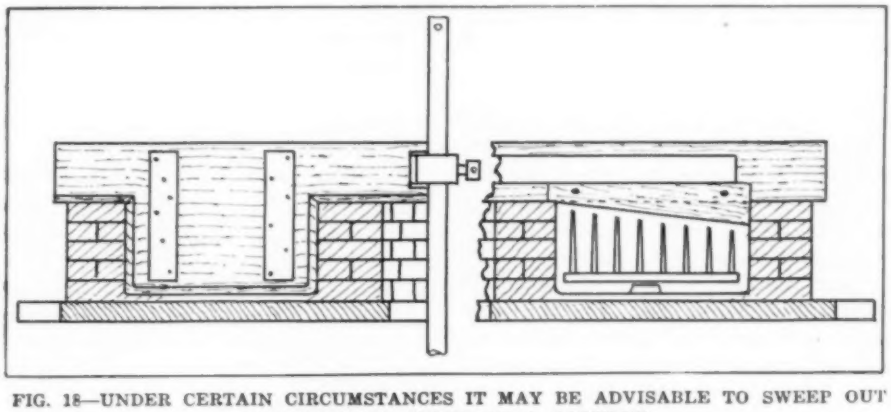


FIG. 18—UNDER CERTAIN CIRCUMSTANCES IT MAY BE ADVISABLE TO SWEEP OUT A CAVITY TO SERVE AS A COREBOX

Alternative Methods

Where a corebox is swept as shown in Fig. 18 the ribs are located temporarily to mark their position. Then they are removed until after the grid has been bedded in a thickness of loam. Remaining sequence of operation in building the core by either method is the same as that described in a previous installment. The interior of the core is filled with ashes and a vent pipe is arranged to communicate with the vent hole in the bottom.

Care is taken to check the ribs several times during the sweeping process and keep them in a vertical position also truly radial from the spindle. With either method, of course, the ribs are cut away on the lower side to span the bars connecting the various sections of the grid. After the cores are baked they are *carded* (rubbed with a hardwood block) to smooth the surface and fillet the corners. The cores may be blacked either before or after the vent cores are fitted.

Some molders prefer to attach the vent core to the main core by grouting around the joint and drying it in place. Others favor the simpler method of placing the vent cores in their prints in the bottom of the mold and then lowering the main core down over them. Each method has its advantages and disadvantages and the principal consideration in either method is to prevent the metal from entering the vent passage. The vent cores are made on short sections of hay rope covered pipe.

Where the prints have been located accurately in both mold and core the first method is reasonably safe. However, the chance of error in location always is imminent and for that reason many molders claim the second method is the safer. In this method the core prints are omitted from the core. The vent cores are placed in their prints in the bottom of the mold and the main core is lowered until it touches them. It then is lifted out temporarily and a vent hole is cut through the loam at each point where the vent cores left an impression. Where it is possible to lift the entire mold the main core is not disturbed, a rod pushed up through the vent pipe is employed to bore a hole through the lower loam wall of the main core.

Whichever method is adopted a free outlet for the gas must be provided. A handfull of shavings or oily waste is placed near the opening in each pipe and ignited before the mold is filled with iron. It is advisable to nail the chaplets on the upper side of the core to prevent any possible dislocation. In locating the upper part of the mold the guide alone is not sufficient for accurate setting. The center of the steamway clearance should be marked carefully on top and bottom and their position should be indicated on the outside of the mold. They should coincide when the mold is assembled.

George A. Scott has resigned his position with the Berkshire Mfg. Co., Cleveland and on the first of January will become sales representative for the Stoney Foundry Engineering & Equipment Co. of that city.

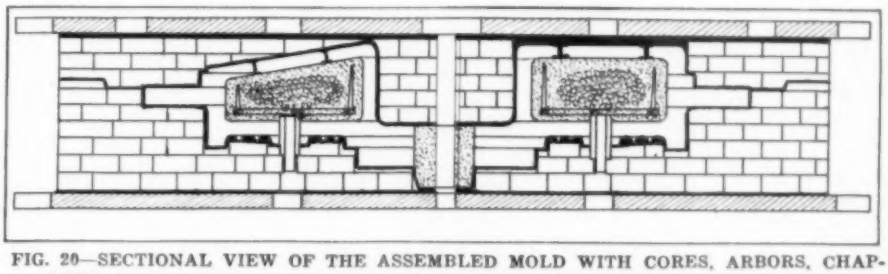


FIG. 20—SECTIONAL VIEW OF THE ASSEMBLED MOLD WITH CORES, ARBORS, CHAPLETS, VENT PIPES, FOUNDATION AND COVERING PLATES IN PLACE. THE POSITION OF THE RUNNERS WAS SHOWN IN FIG. 10

How and Why in Brass Founding

By Charles Vickers

Metal Penetrates Core

We have experienced considerable trouble lately with the cores in brass bushings—the metal seems to cut right through. These bushings are 3½ inches in diameter, 16 inches long, and have a core running through, one inch in diameter. We seem to have more trouble with the smaller cores than with the ones larger in diameter, and will appreciate a plan to remedy this difficulty.

The metal penetrates the smaller cores more easily than it does the larger ones because there is less resistance from gases developed by the heat of the metal. In the larger cores the gas evolved at the surface of the core has to travel through more core structure than in the case of the small cores to reach the vent, and this slow retreat develops a pressure at the core surface that holds out the metal until the latter has cooled sufficiently to be unable to penetrate because it has lost its fluidity. The smaller cores need more surface protection than the larger cores, and they should be given a thicker coating of plumbago. To do this, first wash the core as usual and then when it is dry and warm, rub on a paste of plumbago made by first mixing two-thirds water with one-third water glass, then using this solution to mix with the plumbago to make a paste like flour dough. Rub this on the cores with the fingers, then dry the cores, and if the metal gets through this coating, on the next trip put on a thicker coat.

Duralumin Information

We have an inquiry in regard to our making some castings from duralumin metal. Will you kindly let us know what this alloy is, and also how it is handled in the foundry.

Duralumin is an aluminum alloy containing copper, manganese and magnesium. It is soft and ductile and for that reason is used as a metal to be rolled and drawn more than as a casting alloy. There is no particular reason why it cannot be cast, but being soft in nature its best mechanical properties are not realized in a casting. The composition of the alloy will run about 4.50 per cent copper; 0.50 per cent magnesium and 0.75 per cent manganese and the remainder of the alloy is aluminum. Virgin aluminum is the base metal, and as this is never pure the analysis of duralumin will show a small content of iron and of silicon, bu tnot more than is usually carried by the aluminum, therefore it is not necessary to add any of these elements.

The alloy is handled in the foundry exactly the same as any other alloy of aluminum; that is, it is melted with care to see that no part of the heat becomes more than a dull red at any stage of filling the pot, whether a crucible or an iron pot. It should also be poured as cool as possible. If the casting is not filled out perfectly that means it has been poured too cool and it has been poured too hot if the casting is filled with holes when machined.

Corrosion Proof Bronze

We desire a formula for a mixture of bronze that will withstand cyanide mine waters. All the bronze castings we have made so far are eaten away very rapidly by this corrosive water.

The following alloy will withstand such waters better than any ordinary bronze: Copper 86 per cent; iron 4 per cent; and aluminum 10 per cent.

Bronze Withstands Weak Acids in Paper Mill

We would like to obtain a mixture for bronze suitable for use in paper mills to resist sulphuric acid.

We question whether it is sulphuric acid that the material will be expected to resist as there are few of the common alloys known as bronze that will resist this acid for long, especially if it is heated. Special nonferrous alloys can be made that will resist this acid in all concentrations, either hot or cold, but these are not known generally or cast.

We believe that it is sulphurous acid that is meant, which, is entirely different and any good phosphor bronze can be used in contact with this comparatively weak acid. Thus the following alloy will give good service: Copper 85 per cent, tin 10 per cent, phosphor copper 1.00 per cent, and lead 4.00 per cent.

Ferroaluminum bronze is also a good alloy, one of the best, but it is a difficult alloy to handle profitably.

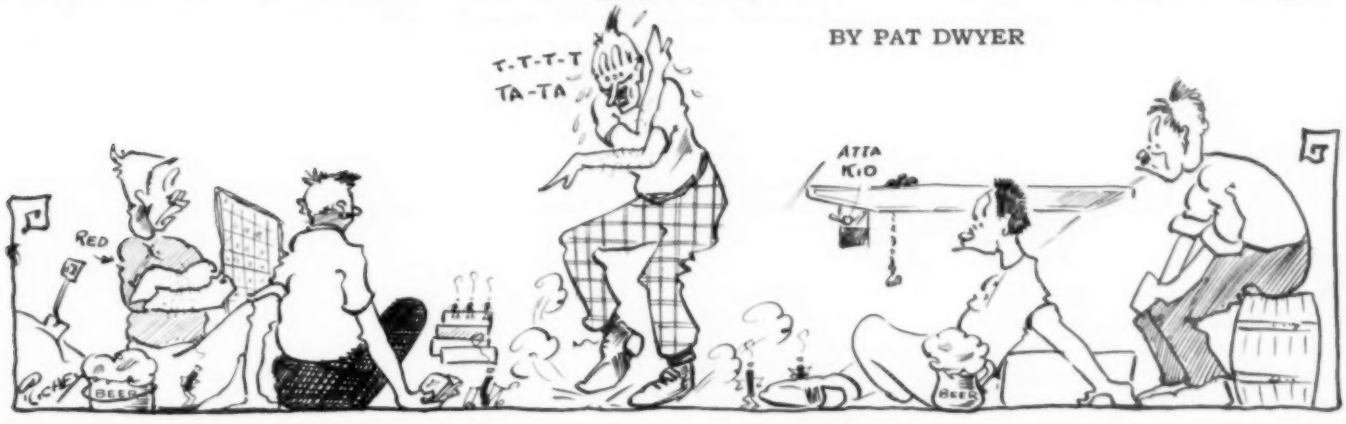
Zinc Causes a Scale

We are using a new mixture of 80 per cent copper; 7½ per cent lead; 2½ per cent tin; and 10 per cent zinc. Immediately after pouring the castings we remove them from the sand and cool them rapidly in water. A greenish-gray scale appears on all castings having a flat surface in the cope. This scale seldom appears in the drag, or sides of the castings. We have thought the difficulty might arise in the melting. We use forced draft furnaces and charge as many pigs of copper as possible in the pot and two on the top, which are immersed as soon as the copper in the pot is melted, when two pigs are placed on the pot again to heat. A flux is added before the first pigs melt. About 15 minutes before the metal is ready to pour we add the mixture. Can you tell us what is causing this scale and how to get rid of it?

The scale appears to a more or less extent on all castings made from alloys containing much zinc and it is caused by the condensation of the zinc fumes on the cold sand surfaces. Obviously, this condensation will be greater on a flat cope surface, and there will be little or none of it on the drag side, or on the sides of the mold. The condensate is first white, but is baked and turned greenish by contact with the metal as it fills up the space. Dusting the molds with flour may be helpful and shallow vents should be scratched from the mold sides to the flask joint to permit the smoke to be blown out of the mold cavity. Some mixtures are more susceptible than others to such effects; usually those containing more tin than is usual in such mixtures of red brass. Since the mixture given is a little higher than usual in tin, try a small heat of copper 80 per cent; zinc 12 per cent; tin 1 per cent, and lead 7 per cent. Reducing the zinc will do away with the scale. The melting may be improved upon. Never put ingots of copper on the top of a pot but put all in at one time when the pot is charged. This may be done by chopping the bottom off old pots using a hatchet. The bilge is set loosely on the crucible, and is not surrounded with coke. The extra ingots are placed in this section and after they are melted it can be removed from the crucible.

Bill Describes Rigging for Making Pipe

BY PAT DWYER



ON SEVERAL occasions recently Bill has importuned me to accompany him to an establishment where dancing is taught and where old fashioned dances are featured once a week on Monday night. Bill is an expert on all the new dances and even demonstrated his agility in the Charleston one night last week, while I was paying a little friendly visit at the house where he spends his sleeping hours and one or two other hours occasionally.

I can't say that I was impressed or that the exhibition created a wild desire in my breast to emulate his example. Bill's legs never would get him a job with Mr. Ziegfeld's well known collection of sprightly young people. Even when concealed inside a pair of reasonably wide trousers, any person endowed with ordinary eyesight can see they are not parallel. A few thousand years ago according to testimony which I have never seen questioned, a gentleman named Euclid laid down an axiom that parallel lines, even if projected to infinity, never will meet.

That seems to let Bill out. His legs meet at the top and bottom, but apparently his knees conceived an antipathy or a mutually violent dislike for each other in early life and gradually they became estranged and grew farther and farther apart at the center as he advanced in years and stature. From my own experience I am inclined to the opinion that long continued exposure to the extreme heat of the foundry during the green or verdant period of his life may be responsible for the warped condition of his curved underpinning. Also, it is only fair to infer that carrying heavy ladles of iron may have exerted a certain influence and given his legs a permanent set closely approximating the shape of a pair of calipers. The simile is rather apt with the single exception that while a pair of calipers may be termed pigeon toed Bill's long flat feet turn out.

He is a living example of the influence of mind over matter. With such a physical handicap the average citizen would no more think of learning to dance than he would attempt to learn how to walk across the ceiling head down like a blue bottle fly. Bill not only learned to dance, but he developed into an expert. Many a time in the old days have I seen him step on a bottom board or on the upper side of a big flat pattern bedded in the floor and give an exhibition of footwork equal to anything I have seen on the vaudeville stage. Two-four or six-eight time was all the same to Bill. He could tap out the measures of a Lancashire clog or an Irish jig with all the grace, neatness and precision of an artist performing on the snare drum.

Single or double beat, fast or slow and with a few grace notes thrown in here and there as his fancy dictated for good measure, his performance was a positive delight to the eye and ear. How he ever manipulated those big hoofs encased in heavy molder's shoes always will remain a mystery to me.

With the same faithful old hoofs correctly enclosed in light and shining dancing pumps he was equally proficient in the so-called fancy dances of the period. Partners in those days did not dance so tightly glued together as modern dancing form demands, but even with that feature in his favor he displayed an agility little short of marvellous in remaining off his partner's toes. He stepped high, wide and handsome and enjoyed a wide measure of popularity through his uncanny ability to step on nobody's toes but the generous supply attached to his own long feet.

Last Monday night, Bill and I, accompanied by our respective wives, attended a session at this modern fountain of youth where we were assured the years would roll away and leave us as we were in the days when we were twenty-one. I do not want to appear uncharitable, but I am afraid the statement is slightly exaggerated. When I was twenty-one I could dance all night, work like a slave all day, dance again the following night and enjoy every minute. On this occasion I was quite willing to quit about 11 o'clock and if any person had suggested a dance on the following night I would have consigned him cheerfully, nay enthusiastically to the deepest and darkest dungeon in the old feudal keep.

Apparently Bill and the ladies enjoyed every minute and I was accused of laziness when I decided to sit on the side lines now and again to watch the crowd whirling around the room. Excepting our own group, I did not know a single person, or for that matter a married person, present and,

IT IS GREAT TO BE YOUNG AND SILLY

therefore, I felt free to notice the expressions on their faces. With a few notable exceptions the dancers seemed to take themselves too seriously.

Naturally, I did not expect to see the elderly couples kicking up their heels in wild abandon, but I was surprised to note the tense do-or-die expression on the faces of the younger people. Probably they were happy, but a jury of their peers, if such a jury could be found, would have difficulty in convicting them from visible evidence. Poker faces probably have a recognized place in the eternal scheme of human endeavor, but they seemed singularly inappropriate on this presumably festive occasion.

The majority of the crowd circled the floor in the waltz, the duchess, the schottische and the heel and toe polka, but several modern sleek haired sheiks and shebas apparently saw no sense in covering so much territory. They did a highly intricate balancing act on a space a few square feet in area. Probably in their sophisticated innocence they thought they were dancing, but to me they bore a striking resemblance to half frozen chickens trying to keep their feet warm on a cold winter day.

'Twas a sad affair contrasted with the merry old dances of bygone days when every person knew each other, when the boys and girls overflowing with the zip and joyous spirit of care free youth danced the hours away on flying feet. Flushed and breathless their smiling faces not only reflected the joy of the fleeting present, but also the romantic visions of the future.

As I sat there resting my poor tired feet and hands a whiff of perfume from a passing dancer carried me back in imagination to other times and other places where I spent some of the most riotously happy years of my life. It was and is but a small town, but each time I think of it I smile pityingly at those who claim that residence in a large city is essential to what popularly is known as having a good time. Certainly I am willing to admit that large cities have certain advantages and that young people probably find fun everywhere, but I know I had all I could assimilate in the little town where I grew up to man's estate. There were times when I found the twenty-four hours altogether too short for the myriad activities and events of the day.

The instant the bottom dropped, the foundry with its attendant dust and grime, trials and tribulations was forgotten and I was out through the door like a rabbit with the old dinner pail in one hand and my coat in the other. Why should I waste time donning the coat in the shop when I could do it just as easily on the run?

A handful of fine sand supplemented the soap and the scrubbing brush in removing the accumulated grime from palms and finger ends. The down of youth was removed with a solid broad razor that had been owned and used by my father for forty years. Originally it had come out of the land of Spain where one of his brothers had tarried for a time in the wild Fenian days of his youth. So far as I know, the case of razors was the only tangible piece of property my uncle brought home as a result of the journey. I don't know whether the blades were fashioned by a cunning old Toledo swordsmith or by some less worthy individual, but never since have I seen or felt a razor that would take and retain such a sweet cutting edge. It is possible that my beard has crystallized and toughened with the years, but at the time of which I write, the old Spanish blade slid over my face as smooth as velvet. The further fact that my father always honed it himself may have been a contributing factor. He had a happy gift with edged tools.

PRACTICING SACRED RITES OF THE TOILET

Dressed to perfection in a tailored suit, set off with light dancing pumps, stiff bosom white shirt held together at the back with a single button, shining, round, detachable cuffs extending an inch beyond the coat sleeves, with a dash of perfume on the shoulder, a bouquet in the top button hole and a modish hat set at a jaunty angle I set off in the amorous dusk of a summer night for the livery stable where I secured a prancing steed and a top buggy to call for the GIRL. What did I care for the toll of $2 to be collected upon my return in the small hours of the following morning?

"Why, nothing," ses you, "and you may lay to that!"

What did we talk about on the way to the dance? I don't know. What did we talk about on the return journey with her head on my shoulder and my arm around her waist while the faithful old horse reeled off the miles? I don't know and if I did I would not tell. For the time being I was in fairyland, the state of enchantment that only comes once in a lifetime and ends for the average person when he assumes cares and responsibilities.

At this point in my meditations I was interrupted by the same shy little maiden about whom I had been day dreaming. She has changed but little in the years that intervened with the single exception that she no longer is shy. "You make me tired" said she. "Sitting there like a dumb Chinese idol. Come on, this is the last dance."

I sat in the front seat with Bill on the drive home and was treated to a monolog on dancing in general illustrated by passing reference to experiences in various parts of the country where he had, as he expressed it, shook a hoof, in his touring days. The name of one town reminded him, as I anticipated some reference would sooner or later, of some of his foundry experiences.

"I worked in this little town," said Bill, "In the early part of 1900 when there was only one jobbing shop in the place and I never have been down that way since. Apparently the town has grown since my time and now supports at least two shops, or it may be that the old shop has changed its name. Anyway I had an inquiry the other day on a letterhead with which I was not familiar, for information regarding the manufacture of pipe. The company had an inquiry for a quantity of bell and spigot pipe to be used for culverts. They had no former experience in this line and wanted to know the best method for making 24-inch pipe in 8-foot lengths.

"I wrote them that was a rather indefinite question and almost impossible to answer without further particulars. At least four methods are available for making this pipe

and the best method to adopt in their case depended on local conditions, the number of pieces required and the present shop equipment. Manifestly the method employed in the regular pipe shops is the cheapest, fastest and most economical, but the cost of the necessary equipment is prohibitive unless it can be distributed over a large tonnage.

"In the regular pipe shops the molds are made in heavy, cast-iron flasks and split longitudinally. The cores are swept in loam on perforated steel plate or cast-iron barrels. The barrels first are covered with one or more thicknesses of hay or straw rope and are equipped with a cross and spindle at each end. The molds are rammed in a pit, vertically, and are dried and poured in that position. The cores are swept while in a horizontal position and after they have been dried they are swung on end and lowered into the mold. A ring core on the top serves to center the main core and also serves as a pouring basin. The core barrels are pulled vertically out of the castings almost immediately after the metal has solidified.

Where a 24-inch ring is available it is utilized in the second method to form both core and mold in an iron flask made up of a number of sections built one on top of the other to the required height. The ring is bedded in the bottom section and then drawn up a few inches after each ramming. A supplementary ring is turned in the lathe and slipped into place on top to form the bell end. A special ring corebox will produce a core to correspond. The cheek may be lifted off and dried and the core may be supported by three or four upright core irons reinforced by a ring arbor at every ramming.

"In the two foregoing methods the castings are poured on end. This is the most convenient method and also one that is the most reliable in securing a uniform thickness of metal. However, with reasonable care these pipes may be molded horizontally in green sand either from a whole pattern and corebox or from a skeleton pattern which forms both core and mold. Where they are molded horizontally a chaplet will be required on the cope side in the center. This feature would condemn them for pressure pipe, but since they are destined for culvert service, the objection will not hold.

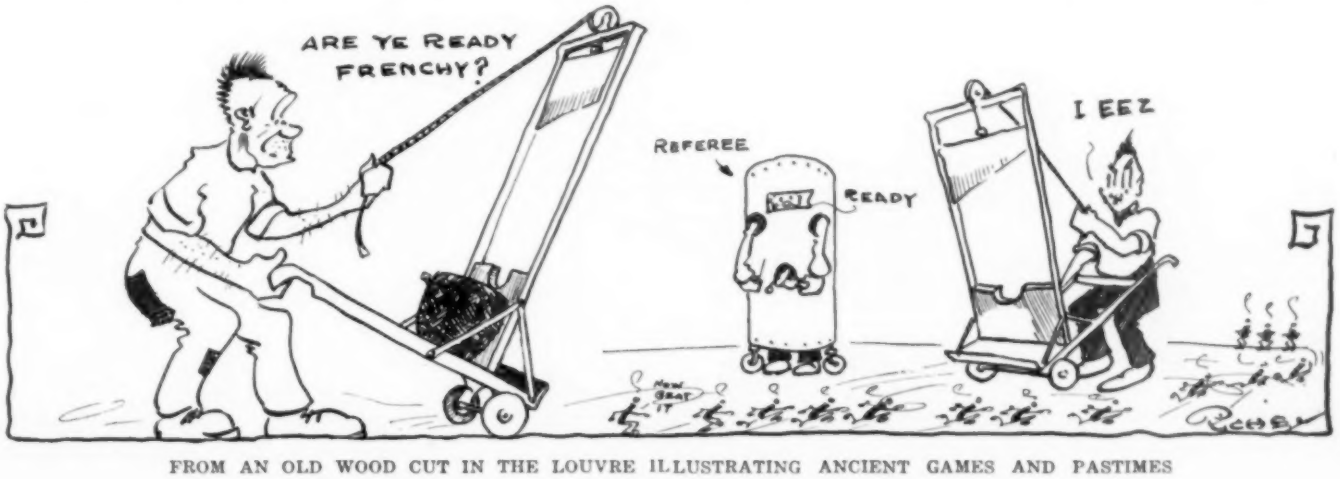
"A whole wood pattern and corebox are made up in the usual manner, that is a number of staves are attached to four half *barrel heads*, one at each end and the remaining two spaced about three feet apart. Where a foundry has a large jolt machine, one-half pattern will be sufficient. Otherwise two halves will be required. The lower half may be bedded in the floor or rammed in a drag. An iron flask practically is a necessity. Pipes up to 24-inches have been made in wood flasks, but they always have been strained oversize. Unless the flask is well braced with bolts or bars across the ends and one or two in the center, the pressure will strain the casting out of shape and the iron probably will run out at the joint. The iron may be poured through a number of branch gates at the joint, or preferably through six or eight ¾-inch pop gates spaced about 6 inches apart in a straight line on the top. The strain on the bottom and top on the joint is not so severe when the iron is poured in this manner.

"The core may be swept in loam on a barrel if one is available or it may be swept in halves on two plates from a regular dry sand core mixture. It is rather difficult to hold a core swept on a plate to size and great care is required in matching the two halves to form a true circle. Usually it is only a compromise and a large fin has to be chipped from the casting. The bell end particularly must be calipered on several diametrical points to insure a reasonable fit for the spigot end of the pipe.

"Where molders are accustomed to the work and where the work has not to be rushed out in a hurry, the fourth method which is known as the skeleton pattern method is the cheapest and most convenient of any. The pattern serves for both pattern and corebox and in that manner the casting may be produced without fins around the prints. Also, the openings in the ends of the pipe will be the proper shape and size. Almost without exception the lower half of the pattern is bedded in the floor. This means that only a cope flask is required. The arbor for the core is easily made in an open sand mold. If no further castings are required after the first order, the arbor makes acceptable scrap for the cupola.

"Several other combinations are within the scope of experienced foundrymen. For example the arbor mentioned in the fourth method may be used with the corebox referred to in the third to make a green sand core. In general it may be said that dry sand molds may be made by comparatively unskilled men. Also, castings made in dry sand molds closely will approximate the desired thickness. Green sand molds for large pipe require the service of highly skilled molders. Even with the best of attention, the castings will exceed their anticipated weight.

"A foundryman has to be adaptable, almost as much so as the Irishman who was challenged in France to fight a duel. He promptly accepted and named a shillegleh as his weapon. His second objected. 'As the challenged party' he said 'you have the choice of weapons, but according to the ethics of the duelo you must select a weapon with which the Frenchmen are familiar.' 'Faith' said Pat, 'that suits me. We'll fight with guillotines!' "



FROM AN OLD WOOD CUT IN THE LOUVRE ILLUSTRATING ANCIENT GAMES AND PASTIMES

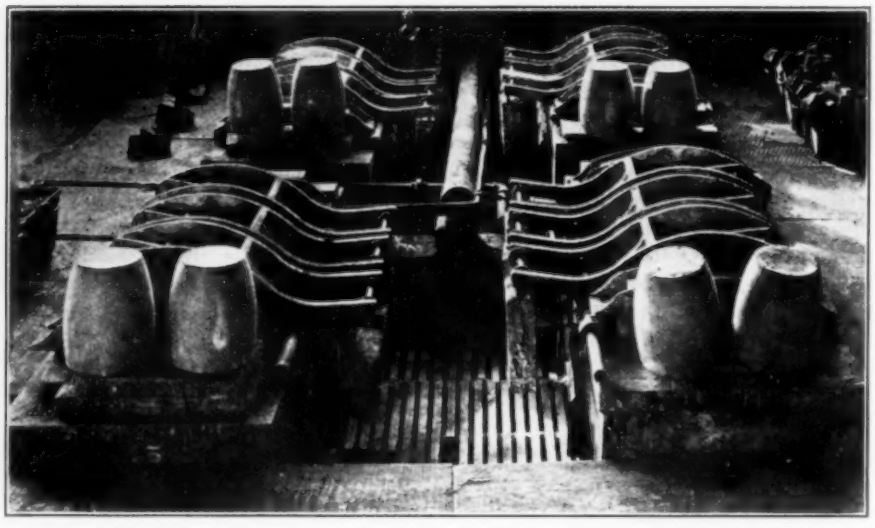


Fig. 1—Four Furnaces Are Grouped So That a Common Supply Line for the Air and Oil Respectively Serve All of the Battery

Removable Plates Provide Ready Access to the Sides of the Furnaces and to the Flues Connecting to a Common Chimney Outlet

Novel Ideas Feature Homemade Brass Furnaces

Photographs Provided by Courtesy of the F. & H. Foundry Co., Inc., Newark, N. J.

THROUGH an ingenious application of established principles, C. Franz, proprietor F. & H. Foundry Co., Newark, N. J., developed an unusually efficient battery of crucible furnaces for melting nonferrous metals. This foundry produces in excess of two million pounds of jobbing castings a year varying in weight from a few ounces up to 1500 pounds. Fluctuating demand made it desirable to find a melting system which would meet varied requirements. Further, the wide variety of mixtures encountered in this class of work favored the use of crucibles, where a shift may be made from yellow brass to aluminum bronze or practically any composition metal, merely by changing crucibles.

The furnace which was designed by and built under direction of Mr. Franz meets all these requirements in an efficient manner. Patterned in some details after the early type of steel melting crucible furnaces, a number of important improvements have been made that are worthy of note. As may be observed from the accompanying illustrations, the furnaces are depressed to bring the tops on a level with the floor. Air and oil are piped through the outer wall at the floor level. The flues for lead-

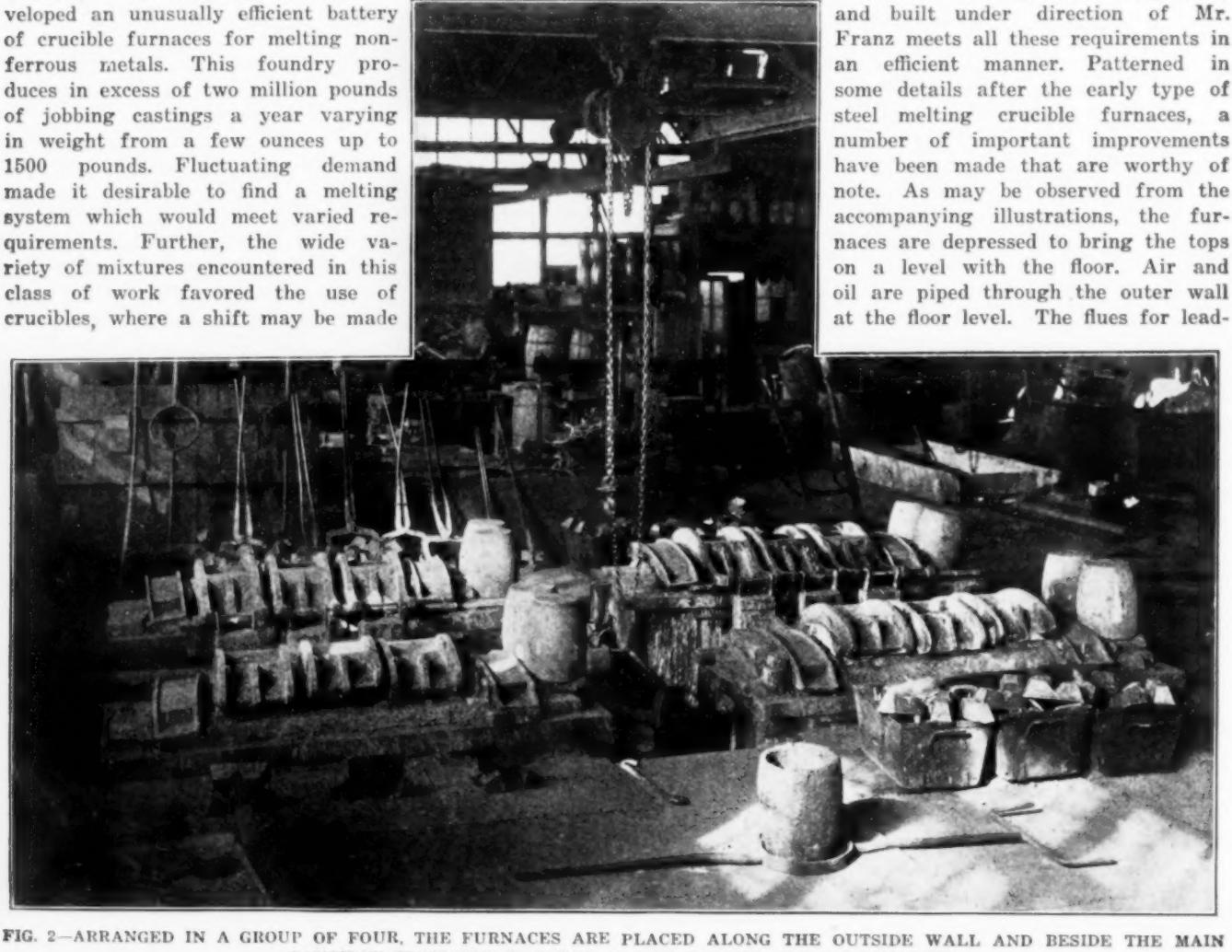


FIG. 2—ARRANGED IN A GROUP OF FOUR, THE FURNACES ARE PLACED ALONG THE OUTSIDE WALL AND BESIDE THE MAIN GANGWAY FROM THE MOLDING FLOOR TO THE CORE DEPARTMENT

ing the exhaust gases to the chimney are placed beneath the floor level and covered by safety plates. Operating the hinged and counterweighted covers, applying the tongs to the pots and lifting them from the furnaces in no case brings the melter directly over the heated furnace.

The battery consists of four units, each of which may be operated independently. Each furnace has a capacity of three pots, accommodating either the No. 60 or No. 80 crucible. From this, it may be noted that the maximum melting capacity of the battery is about 2800 pounds of metal, starting cold, the first heat is melted down in 1½ to 2 hours. Subsequent to this, with the furnace and pots hot, the melting time is 45 minutes to an hour, giving a maximum output in excess of 22,000 pounds for 8 hours operation although ordinary practice gives less than this total. The entire battery was built and installed at a cost reported by the F.

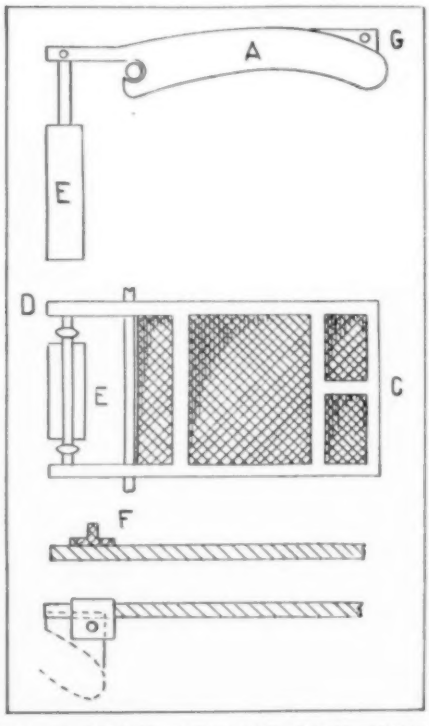


FIG. 3—DETAIL OF CAST IRON BUNG FRAME AND TOP AND SIDEVIEW OF LIFTING BAR EMPLOYED

& H. Foundry Co. as slightly more than $1000.

Each furnace is rectangular, 3 x 3 x 6 feet in outside dimension. It is constructed of angle iron sections welded together to form a frame, with a solid steel plate bottom. This skeleton box is lined with firebrick on the four sides, while the bottom is covered with a layer of sand and coke dust on which the firebrick bottom is laid. The top is

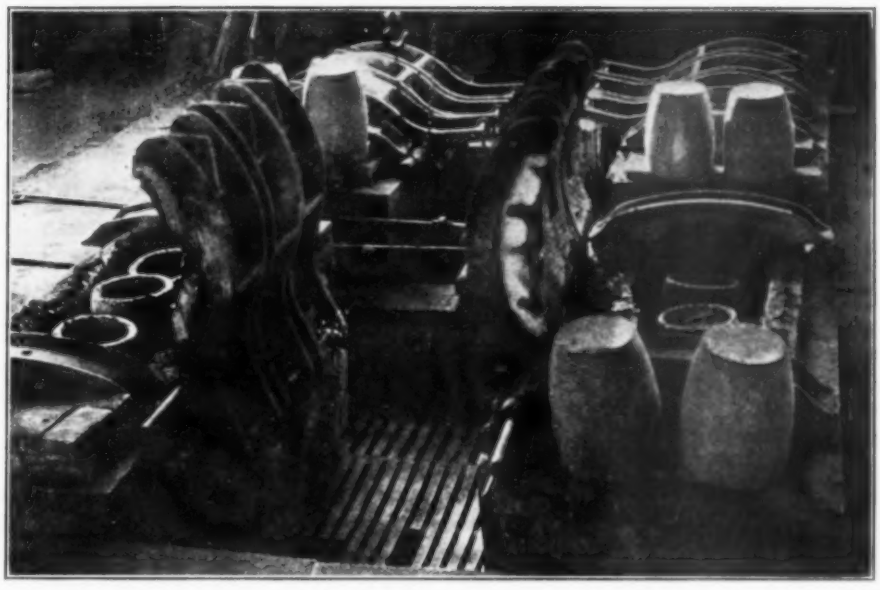


FIG. 4—THE TOP OF THE FURNACE IS FITTED WITH THREE BUNGS, ANY OF WHICH MAY BE RAISED TO PLACE OR REMOVE ANY ONE OF THE CRUCIBLES

strengthened by two cast iron arch sections, one at each end of three cast iron bungs. The latter extend outward at the back to carry counterweights and are mounted at the wall line on a pipe, so that each may be swung upwards as on a hinge. The bungs are lined with special fireclay blocks, proportioned so that when the bungs are closed, the brick lining just clears the tops of the crucibles within the furnace.

Detail of the bung is shown in Fig. 3. The frame, made of a single iron casting, is reinforced by two transverse webs running across between the sides. The side view of the frame is shown at *A* and the top view at *B*. The triangular shaped lug *G* at the center, offers purchase for a special lifting bar employed. The two sides of the bung frame are extended beyond the hinge to clear the side walls of the furnace where they are joined at *D* by a rod. A counterweight, *E*, is suspended from this rod by hooks in such a manner that when the bung is swung upward on the rod upon which it is pivoted, the weight drops downward against the outside of the furnace wall. This action is illustrated in Fig. 4.

A detail of the lifting bar is shown in the lower portion of Fig. 3. The small pin, *F*, engages the eye *G* and when the free end of the bar is elevated, leverage is exerted against the top of the bung and the latter swings upward on the pivot rod or hinge at the back. Only a slight pressure is required to lift the bung which weighs about 400 pounds. The crucible is gripped by a special shaped tongs and lifted by the chain hoist shown suspended from the traveling girder in Fig. 2 and propelled to a point over the grating near the side of the furnace where it may be lowered into a shank.

It will be noted that the furnace in each case is long enough to accommodate four pots. This was the original intention, but after trial, it was found that the fourth pot, far removed from the burner end of the furnace, failed to heat. Accordingly the space allocated to this pot was filled loosely with firebrick, covered tightly, and this additional space on the top now is used for preheating or drying crucibles.

As was mentioned, the air and oil lines enter the building through the outer wall. A main header from the air compressor, located in an adjacent building, is located between the two pairs of furnaces, with pipes to the individual burners controlled by cutoff gates. The oil line, which is the smaller pipe alongside the compressed air header shown in Fig. 1, brings oil by gravity from a storage tank in the yard immediately outside the building. A burner, made by the W. N. Best Corp., New York, and inserted in each furnace about 4 inches below the top line is directed at a slight downward angle. A triangular block of refractory material placed directly in front of the burner divides and directs the impinging flame to the right and left along the sides of the furnace so that it does not strike the first crucible directly.

The flame velocity is low since the oil is gravity fed and an air pressure of only 1 pound per square inch is used. The path of the gases is around the pots and toward the back of the furnace, where the loosely laid

firebrick occupying the space designed for the fourth pot act as a baffle. The gases pass between these loosely laid brick down to the bottom of the furnace, where a 12 x 12-inch opening permits egress to the flue.

That heat is distributed uniformly throughout the entire furnace is evident from the fact that metal is melted in the pot at the back of the furnace as quickly as in the one directly at the front. When taken from the furnace, the crucibles retain a soft cherry red color taken by the melter to indicate an even soaking heat. Charcoal covering is used in melting brass, although no trouble has been experienced from excessive oxidation. Only a slight escape of heat is noted through the top. The flame between the bungs when the heat is melting is less than 4 inches high.

Oil employed by Mr. Franz in operating the furnaces is either a light distillate or waste oil obtained from automobile filling stations where free draining service yields a supply of oil which has been found satisfactory. The oil consumption is given as 1.97 gallons per hundred pounds of metal melted, an average obtained over 3 months operation. Crucible life has been found to average from 24 to 30 heats, and the maintenance expense as represented by renewal of linings since the furnaces were put in service has been nil.

Construction of the bottom in the manner mentioned, that is with a solid steel plate, covered with waste coke dust and sand upon which bricks are placed, results in a saving of metal. All spilled or overflow metal, or that which is deposited in the furnace by an accident to a crucible seeps through to the sand and is stopped by the steel plate at the bottom. This metal easily may be recovered, merely by removing the brick and shoveling the residue from the surface of the steel plate. The saving reported from this source and from the pieces which from time to time the melter carelessly allows to drop beside instead of into the crucible in charging amounts to about 3 per cent.

California and Washington produced all the domestic magnesite consumed in this country in 1924. The amount of crude magnesite produced was 120,100 short tons, equal to 57,920 tons of the refined product. Of the total amount produced 29,830 tons or 51 per cent was used for refractory purposes.

Expansion Work Started

The Ferro Machine & Foundry Co., Cleveland, is enlarging its plant and installing additional equipment, the improvements costing about $150,000. Three new buildings are included in the expansion program, one for housing the complete maintenance department, one containing the cleaning department for small castings and one for hot casting storage. The new buildings will permit the use of some space in the present buildings for a new core department.

Considerable equipment will be installed, including three mold conveyors, one complete sand handling unit and 12 core ovens. In connection with the additional hold conveyors, the metal handling equipment will be enlarged and 12 new molding machines will be installed, these machines being purchased from the Stoney Foundry Engineering & Equipment Co., Cleveland. The cleaning department will require eight additional tumbling barrels and the melting department a new cupola. Considerable miscellaneous equipment also will be required. The plant will have a capacity of 400 tons melt per day when the program is finished. The engineering work is in charge of the Stoney Foundry Engineering & Equipment Co.

Association Reorganizes

Philadelphia Foundrymen's association is in process of being reorganized. Instead of nominating officers for the ensuing year at the meeting on Dec. 8, the association appointed a committee to draft a new constitution and make its report next May. Present officers will occupy their places until that time, and it is expected the next election will occur in June. The constitution committee has as its chairman C. F. Hopkins, vice president of the association, and second vice president of the Ajax Metal Co. Other members are R. R. Belleville, Joseph Dixon Crucible Co.; H. M. Giles, Westinghouse Electric & Mfg. Co., and R. E. Blazo, Barrows & Co. Charles R. Spare, president of the association, and president of the American Manganese Bronze Co., and Howard Evans, secretary of the association, and director in the J. W. Paxson Co., are ex officio members of the committee.

Walter Wood, R. D. Wood & Co., talked about a plan to make Philadelphia an important pig iron producing center. He said that some 500,000 tons of pig iron have been imported this year and that this entails great losses in various directions.

Mr. Wood cited figures to prove that the pig iron consumption in the Philadelphia territory is sufficiently large to support a heavy production in Philadelphia. He reported that questionnaires as to their pig iron needs had been sent out to 520 foundries in the district. Of these, 250 had replied, showing a combined consumption of 684,000 tons a year. The melt of the Burlington plant of the United States Cast Iron Pipe & Foundry Co., said Mr. Wood, would bring the total to 800,000 tons. The foundries not reporting would swell the total by some 400,000 tons, Mr. Wood estimated. He believes that 1,200,000 tons of foundry iron are consumed in the immediate Philadelphia district.

Stanley G. Flagg Jr., Stanley G. Flagg Co., Stowe, Pa., addressed the meeting on plans for entertaining foreign foundrymen who will visit this country to attend the annual foundrymen's convention next fall. Present plans call for a welcoming dinner and a tour of inspection of representative foundries in the Philadelphia territory.

New Company Formed

The Pelton Steel division of the Stowell Co., Milwaukee, has been taken over by the Pelton Steel Casting Co., a new corporation. There has been no interruption in operations, the new company maintaining the operating and sales organization of its predecessor, and occupying the plan formerly devoted to the manufacture of steel castings by the Stowell Co.

Officers of the new company are as follows: Arthur J. Ehne, president and treasurer; Thomas E. Ward, vice president; H. A. Leekley, vice president in charge of operations; Allen M. Slichter, secretary and sales manager. The company specializes in electric steel castings for automotive, tractor, agricultural machinery, etc.

Appointed Manager

E. A. Hurme recently has been appointed manager of the electric furnace section of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The rapid increase in the use of electricity for heating purposes has made necessary the division of the industrial heating section into three sections. Mr. Hurme was formerly manager of the steel mill section of the industrial sales organization.

Charles Piez, Chicago, president of the Link-Belt Co., Chicago, has been re-elected president of the Illinois Manufacturers association.

Patternmaker Uses Pincers

Pincers and Pliers Necessary for Pulling Short Nails and Brads and for Cutting Wire

By Walter C. Ewalt

STEADY progress of the human race from primitive life to our present civilization has kept pace with the advance in man's ingenuity in inventing and developing tools. A vast space of time lies between the period when man first devised tools to help him in his fight for existence, and today when the mighty turbines at Niagara furnish enormous quantities of power to turn the wheels of industry. However, at some time between these two periods, a civilization raised its head out of that dim past and rapidly advanced. This advancement was possible partly because men found a way to write, or to communicate with one another. The first writing was in the form of pictures or paintings which have been found in caves in France and Spain, this method extending to the time of those ancient people who lived just before the Babylonians. The first people to write used pictures of animals, plants and other objects and characters in their writing, these heiroglyphics being the first intelligible ideas of ancient people that have been read by the later civilization. The Babylonians improved the use of these characters by using them, not only for ideas, but also for sounds. These people also invented a tool called the stylus by which they impressed these cuneiform characters in brick.

One of the greatest inventions ever made, namely that of printing with movable type, is the tool by which civilization has advanced most rapidly. This invention has made possible the distribution of the thoughts and ideas of man in all directions and in all countries, so that today, we are benefited by the lessons and experiences of millions of men who have lived in the ancient past and are living in the present. If the majority of us have just one original idea of real importance during our life, we should consider ourselves fortunate.

Wonderful natural resources and the fact that we are the greatest inventors of tools makes this country one of the greatest nations in the world today. This does not mean that all of the wonderful tools have been made in this country, but applies rather to those having the most labor saving value. Activity in creating and designing new tools must continue if this country is to endure, for, as in the past, our whole welfare depends on further developments.

The man buying tools should not limit his purchases only to those he thinks he can afford, but in such cases he should wait until only the best may be acquired, even at the expense of securing only a few at a time. There are numerous reasons why this is true, the greatest trouble being that the cheaper tools hamper advancement. For example, consider using a poor grade chisel. Regardless of the number of times this type of chisel is ground and sharpened, it will not hold an edge. If used by a beginner he often becomes disheartened and loses interest. The beginner should be given good tools, and should not receive those which some times are referred to "good enough for him." The matter of economy of time also should be considered in the purchase of tools, as poor tools cause the loss of considerable time. Poor tools may chew off the wood, but good tools make the working of wood a delightful occupation. For these reasons the tools used by any workman should be of the best to make it possible for him to secure the best results.

Carpenter's pincers are shown in

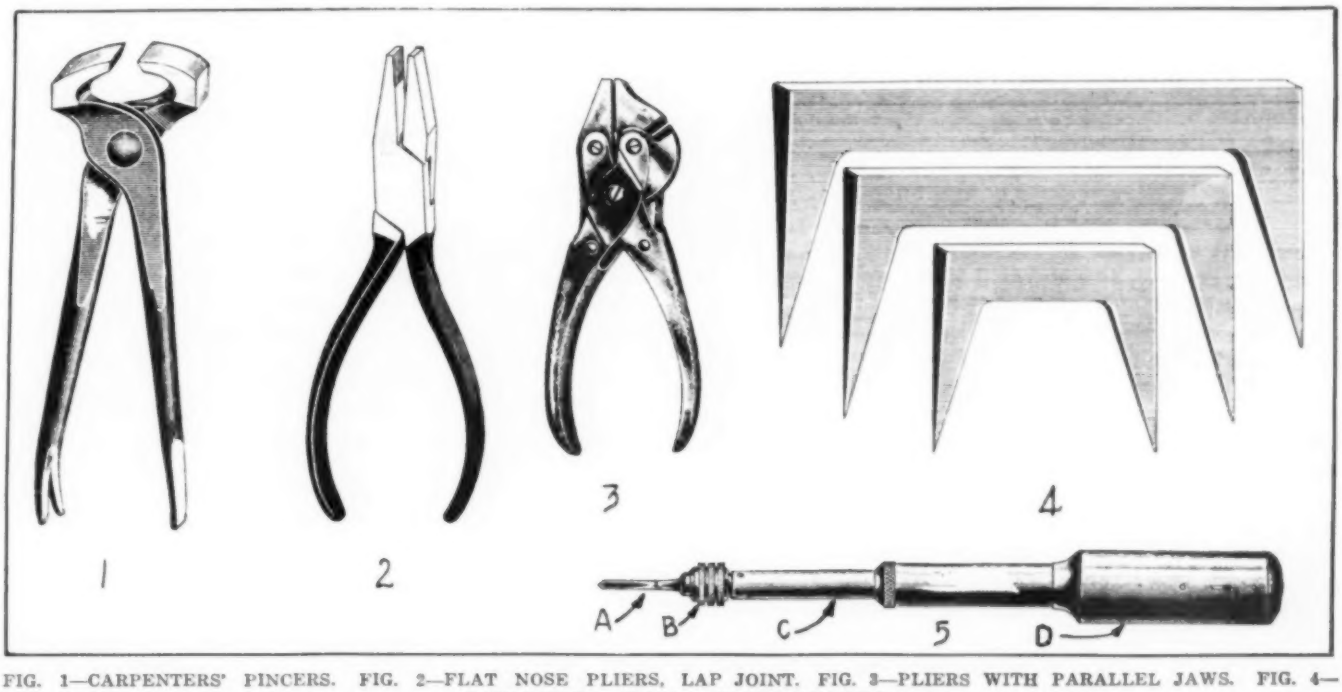


FIG. 1—CARPENTERS' PINCERS. FIG. 2—FLAT NOSE PLIERS, LAP JOINT. FIG. 3—PLIERS WITH PARALLEL JAWS. FIG. 4—PINCH DOGS. FIG. 5—AUTOMATIC DRILL

Fig. 1. The followers of Isaac K. Walton will recognize this implement as an essential catfish skinning tool. The patternmaker uses this tool to cut wire and brads. Because its shape is round at the bottom, this tool is of considerable use in removing brads and nails, especially in narrow places where it would be impossible to use the claws of a hammer. The pincher should be made of forged steel. The jaws should be kept sharp and the bevel ground short so that the edge will not be destroyed when hitting a nail. Several styles of pincers are made for the woodworker, the one shown being called a hammer head pattern. The outside of each jaw has a flat part enabling its use as a hammer. A screw driver is located at the end of one handle while claws for pulling nails are provided at the end of the other handle, either handle being useful for prying. This is a handy combination tool and should be included in a regular kit of tools. The pincers come in sizes 6, 7, 8, 9, 10, 12 inches in length, the 6-inch size probably being the best for the patternmaker.

The flat nose plier is shown in Fig. 2. This style of plier is used for holding, bending and pulling brads and nails. Perhaps the same style, but having side cutters in addition, would be much handier for the patternmaker, as it also would be possible to cut brass and nails up to certain thicknesses. A type of plier with parallel jaws is shown in Fig. 3, it being found convenient to use this style of pliers in holding an article having parallel sides. The handle and jaws are in the form of a compound lever, making it sufficiently powerful to cut a ten-penny nail in the cutters which are located about the jaws. Various purposes require many different styles of pliers, but for all around use, the last mentioned is considered best by many.

Pinch dogs, several of which are shown in Fig. 4, almost are indispensible in making wood patterns. They are made in the form of a square staple and are forged from steel. Pinch dogs with square corners should be obtained, as this type will drive much easier than where the corners are round. This tool is used to fasten pieces of wood together when building up a pattern temporarily. Later when the pieces of wood are glued together, the dogs act as clamps making the points tight. Pinch dogs also are found convenient when gluing up pieces which are too large for ordinary clamps, for example, when gluing a row of six or eight pieces of 1 x 12 inch stock lying side by side. The dogs also are used to fasten the halves of patterns together while turning on a lathe. They are withdrawn easily with pliers or screw drivers and the small holes which are left in the wood are filled easily with wax or plastic wood.

An automatic drill or boring tool is shown in Fig. 5. The various kinds of bits used in this tool were described in an article on bits which appeared in the Dec. 1 issue of THE FOUNDRY. This drill has a ratchet movement which makes it exceedingly useful in places where the working room is small. A magazine is located in the handle which holds eight drills 1/16 to 11/64 inches. These drills may be seen plainly when the magazine is open. The length of this tool from the top of the handle to the tip of the drill point is 10¾ inches. This tool takes the place of the bradawl to a certain extent. In Fig. 5 the drill is shown at *A*, the chuck at *B*, the bar which runs into the handle at *C* and the handle at *D*. A helical thread is located on the end of the rod *C*, this thread engaging in the thread cut on the inside of the handle *D*. A spring in the handle presses against the rod *D*. The drill is placed against the work and the handle is pressed down, thus causing the drill to revolve. This motion causes the drill to enter the work. When the pressure against the handle is removed the spring brings the handle back to its normal position, and at the same time the motion of the drill is reversed.

Expect Building Boom To Continue

The annual forecast issued by the *Architectural Forum* New York, predicts a total expenditure in the vicinity of six billion dollars for building construction in the United States during 1926. This prediction, which is based upon a survey conducted among architects and builders, gives a summary of the amount of building contemplated for the coming year.

The results of the survey are tabulated according to six geographical divisions. This indicates that the same relative building activity may be expected in each of these districts with perhaps slight increases in the southeastern states over the record total reached in 1925. The total number of building permits which it is predicted will be issued in 1926 is given as 778,440, of which 274,000 will be for private garages, 193,000 smaller residences and 163,420 farm buildings other than dwellings. The expectation for industrial buildings is 9,782 and office buildings is 3,074.

The reports of this publication have proved to be conservative and close to actual figures compiled at the end of the year over the past five years, the period for which they have been compiled.

Plans To Broaden Sales of Equipment

The Northern Engineering Works, Detroit, which has concentrated on crane selling for two years past, is preparing to resume the sale of foundry equipment on a large scale. The company plans to outfit foundries complete with the exception of molding machines and sand mixers. Included in the list of equipment it is offering, are cupolas, tumbling barrels, ladles, industrial turn-tables, shop trucks, pneumatic hoists, electric hoists, core oven cars, overhead monorail systems, and I-beam trolleys. It also will continue to sell overhead cranes.

DetermineGasesinMetals by Vacuum Fusion

Gases whether they exist as oxides, nitrides, or hydrides are known to be present in some metals. Heretofore there has been no exact, dependable method for the determination of these contained gases, but recently a new method was developed at the bureau of standards by Louis Jordan and James R. Eckman.

The method consists in a vacuum fusion of the metal in a graphite crucible heated in a high-frequency induction furnace. A sample of from 20 to 60 grams which may be in a single piece, thus avoiding surface oxidation of chips, is fused in the furnace. The various gases evolved during the heating are absorbed in a suitable absorbent train and the determination of gases is calculated from the increase in weight of the absorbent tubes.

This method is applicable to the accurate determination of oxygen in pure iron, steels, cast irons and pig iron, and it may be used also on many nonferrous metals and alloys.

A description of the method and the apparatus used is given in scientific paper of the bureau of standards, No. 514. This publication may be obtained from the superintendent of documents, government printing office, Washington, at a cost of 10 cents.

Milestones in Foundry Progress

Recorded in the January Issues of THE FOUNDRY, Thirty, Twenty and Ten Years Ago

1896

RAILROAD, pipe, stove and agricultural shops were running full time when January ushered in the year 1896, according to THE FOUNDRY of that date. Pig iron prices were sagging, but the outlook was for advances in line with coke, ore and railroad rates. Politics, since this was presidential year, were agitating the well-known industrial confidence.

* * *

The title "breezy west" was justified by a newspaper report of a foundry in Kansas City, Mo., that melted ten million tons of pig iron a year and cast building columns, sills, washers and smokestacks.

* * *

William Sellers & Co., Philadelphia, were making brass injectors which were described at length with illustrations of the patterns and cores used.

* * *

Western Foundrymen's association met in Chicago and talked about systems of storing patterns and records in a discussion led by P. H. Dingley. An argument developed as to whether the value of a pattern was the amount necessary to replace it, or whether the pattern represented an asset to be determined from the value of the work made off it.

* * *

Noah's two sons, Shem and Ham were in the foundry business. Immediately after landing from their voyage in the ark a disgruntled customer brought suit for nondelivery of castings on contract. The wise judge in dismissing the suit at plaintiff's expense called attention to the minute line reading, "Not responsible for fire, strikes, flood, etc.," thus originating a most valuable alibi, it is said.

* * *

A. Sorge, Jr., recommending a division of labor in foundries, advocated a separate gang for cutting sand, some one to supply the molders with gaggers and other necessaries to their work and a distribution of all activities to specialists.

* * *

Wouldn't a trip through the Ford plant be a treat to this gentleman today?

Faked Foundry Facts

Low Pressure

Pokey, the unsophisticated foundry owner took a bunch of lady visitors into his shop at pouring off time, to the disgust of his foreman, Tom Bowers. The extra activity, incident to *showing off* almost wrecked the place.

* * *

The Walker Foundry Co., Erie, Pa. was building an addition.

* * *

J. H. Bass, proprietor, Bass Foundry & Machine Works, Fort Wayne, Ind., reported contracts for two million dollars worth of castings placed with his shop in the preceding thirty days.

1906

ADVANCE THRESHER CO., Battle Creek, Mich., had a new foundry which was described in the January, 1906 issue of THE FOUNDRY.

* * *

John McCune commented caustically on foundry goldbrick men. He cited one whom he placed in this classification through claims made that potassium permanganate with other chemicals, placed in the air line leading to the tuyeres liberated oxygen to "ozonize" the entering blast, with beneficial results.

Why not try some nice fragrant, ripe limburger It would be equally effective.

* * *

No. 2 foundry iron was quoted at $18, Pittsburgh and $14.50 to $15 a ton, Birmingham. Foundry business was excellent according to trade report.

* * *

A discussion of various designs of air furnaces was in progress. N. W. Shed believed in a perfectly level roof, but an increasing area of bed toward the end of the furnaces at which the stack is placed. He also advised a jet of steam or forced draft under the grates.

* * *

RUTHLESS RHYMES

A sturdy young Russ from Odessa,
Was christened by friends, Ivan Offelitch,
He couldn't read signs that express a
Sharp warning, "Keep hands off the switch."

A. V.

* * *

The Northwestern Steel & Iron Works, Eau Claire, Wis., had just completed a new foundry.

1916

WARTIME prosperity was abroad in the land. Foundry operations throughout 1915 had been increasing. Pig iron production was leaping forward and a difference of $5 a ton between the Jan. 1, 1915 and Dec. 31, 1915 prices on practically all grades was noted in THE FOUNDRY of January, 1916.

* * *

The foundry of the Packard Motor Car Co., of which Emil B. Horne was then superintendent was described.

* * *

D. Dalrymple, president of the Birmingham branch of the British Foundrymen's association commented upon the saving in cost due to using pattern plates.

* * *

The Electric Steel Co., Chicago, now the Nugent Steel Castings Co. was organized to manufacture small castings.

The Shakeout

DAN M. AVEY, Editor
PAT DWYER, Engineering Editor
CHARLES VICKERS, Nonferrous Editor
FRANK G. STEINEBACH, Associate Editor

¶ Straws Indicate A Fair Wind

ACCORDING to an old proverb that originated when the great mass of the people were more closely connected than at present with agricultural pursuits, straws show which way the wind blows. Many of those engaged in the manufacturing industry today know little about straw. They have a vague idea it is used in the manufacture of straw hats and sometimes is employed by newspapers to take a poll of the country on this or that momentous question of the day. However, practically every person over the age of seven is familiar with the meaning and practical application of the proverb. They may not refer to the various hints, rumors, news items and current gossip as so many straws, but if they are running a venture on the sea of business they place great credence in these various manifestations of how the wind is going to blow and they trim their sails accordingly.

FOR the past few years the pessimist has been abroad in the land. He has bewailed the fact that the foundry capacity has been expanded out of all proportion to the demand and as a result the prevailing dog-eat-dog policy of price cutting probably will obtain for many years. Like every other popular belief this is partly right and partly wrong. The foundry capacity was expanded unduly at the time, but a great many straws in the air recently seem to indicate that the slack is to be taken up and that comparatively few floors are unoccupied. The Ohio State Foundrymen's association reports business at 92 per cent of capacity in October. Automobile manufacturers announce larger outputs for the coming year. Malleable foundries are booked fairly well ahead and are beginning to pick and choose among the orders to be accepted.

WHEN the fig tree and the other trees put forth their leaves we know summer is nigh. When foundries are filled and in a position to take an order or leave it alone the customer usually prepares himself to pay a premium in the form of advancing prices. The situation is not peculiar. It represents a condition that always prevailed and always will prevail so long as men buy and sell. For a considerable period the foundrymen have been on the short end of the balance. According to the straws that constantly are growing more numerous as the year draws to a close, the foundryman has a fair prospect of coming into his own in 1926.

¶ Collecting on Research

RESEARCH properly applied and correctly interpreted can be made most useful in producing industrial superiority. Its advantages are shown in competition between industries, between companies within an industry and more broadly its effect is stamped on the race of nations for commercial supremacy. Research improves old processes and creates new ones. Realizing the importance of research to industry, the British government created a subsidy to promote co-operative research associations. France allows manufacturers to deduct a percentage of the funds appropriated for research from their income tax while in Germany research is almost a fetish in industry.

UNFORTUNATELY, the results of research are indirect. They do not show on the black ink side of the ledger and in many instances the research department is regarded as a sort of a drain pipe into which money is wasted. Companies with such ideas simply maintain research departments because their rivals do. They do not realize the benefits to be derived from carefully conducted research programs. They skimp on funds, employ men as cheaply as possible rather than pay sufficient to obtain intelligent workers, buy inadequate equipment, and at the first opportunity wield the axe under the plea of economy.

Research should be placed on a higher plane. It should be considered in the light of its achievements. It should be judged by broad consideration of results. Research departments never should be rated as millstones around the neck.

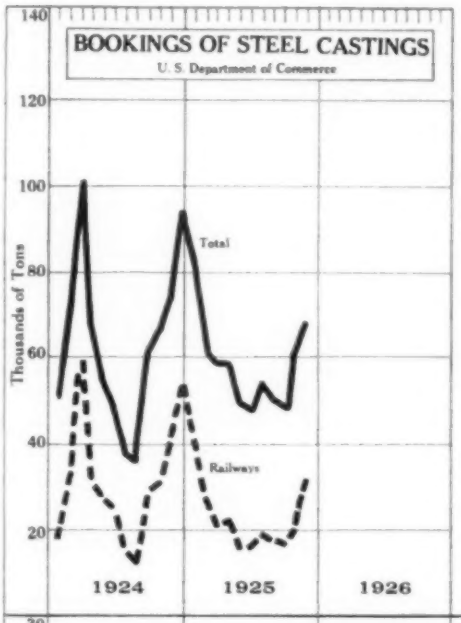
Trade Trends in Tabloid

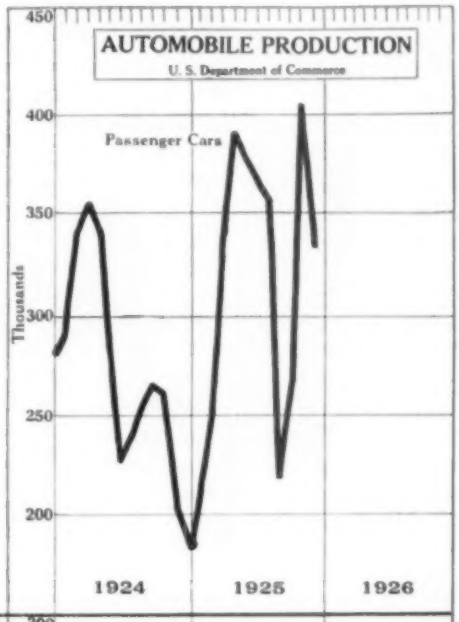
SUSTAINED general prosperity promises much for the foundry industry during 1926. Sales of commodities, shipments of freight, construction activity, farm product prices, continued peak production and sales of automobiles and railway buying all have a direct or indirect bearing upon the demand for castings. These presage increasing foundry business for the early part of the year. Steel foundries are climbing steadily out of the depression which struck them in midyear, 1925. General jobbing business is improving in practically all centers. Malleable operations which depend largely upon railway and automotive demand, are improving. Machine tool sales are picking up and heavy machinery needs are growing. Stove and furnace interests are busy, and with plumbing goods shops are sharing the benefits of the high rate of building construction that has been maintained into the winter season.

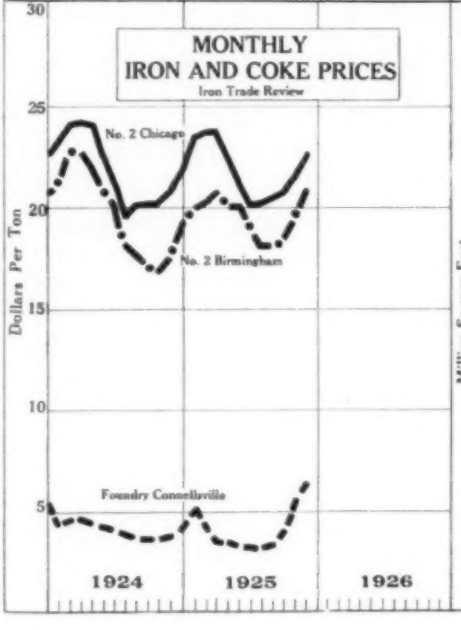
Starting with this issue, THE FOUNDRY inaugurates a method of presenting the basic facts affecting foundry business. A series of charts which will visualize the changing factors that bear directly upon castings demand will be given in each issue. These will be varied, one group appearing in the first issue of the month and a second selection being shown in the fifteenth. Price tables will be given as before and each development in the trade outlook noted.

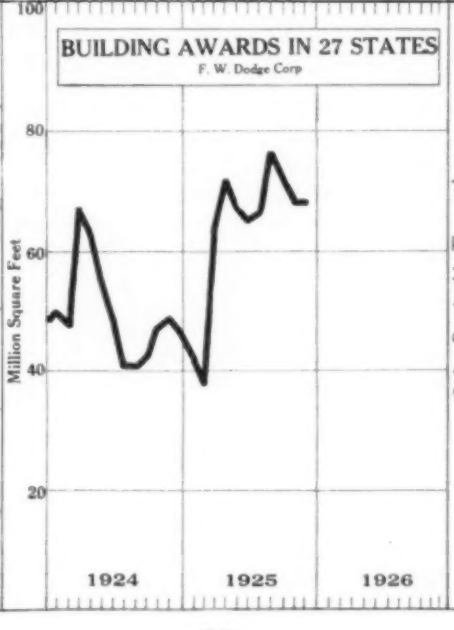
RAW MATERIAL PRICES
DECEMBER 19, 1925

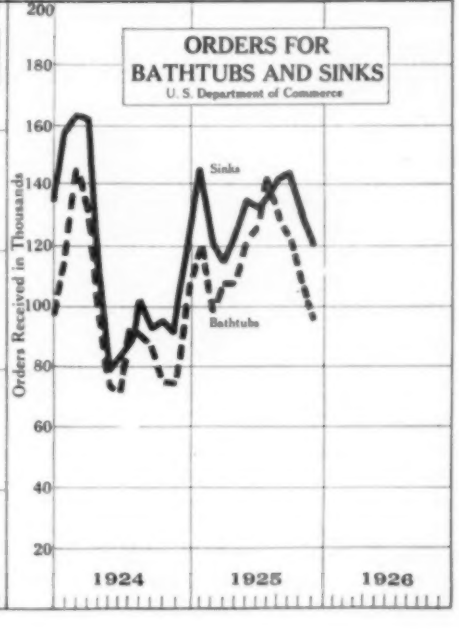
Iron	
No. 2 foundry, Valley	$20.50 to 21.00
No. 2 Southern Birmingham	22.00
No. 2 foundry, Chicago	23.00
No. 2 foundry, Philadelphia	23.76 to 24.26
No. 2 foundry, Buffalo	21.00 to 22.00
Basic, Valley	21.00 to 22.00
Basic, Buffalo	20.00
Malleable, Chicago	23.00
Malleable, Buffalo	21.00 to 22.00
Coke	
Connellsville foundry, coke	$5.00 to 5.50
Wise County foundry, coke	7.00
Scrap	
Heavy melting steel, Valley	$18.50 to 18.75
Heavy melting steel, Pitts	19.00 to 19.50
Heavy melting steel, Chicago	15.25 to 15.75
Stove plate, Chicago	16.50 to 17.00
No. 1 cast, Chicago	19.00 to 19.50
No. 1 cast, Philadelphia	18.50 to 19.00
No. 1 cast, Birmingham	17.00 to 17.50
No. 1 cast, Buffalo	18.00 to 18.50
Car wheels, iron, Pittsburgh	18.50 to 19.00
Car wheels, iron, Chicago	18.00 to 18.50
Railroad malleable, Chicago	18.00 to 18.50
Agricultural, mall., Chicago	16.75 to 17.25
Malleable, Buffalo	20.00 to 20.50
Nonferrous Metals	Cents per pound
Casting copper, refinery	13.62½
Electro copper, producers	14.25
Straits Tin	63.25
Lead, New York	9.35 to 9.45
Antimony, New York	22.00
Nickel, electro	38.00
Aluminum, No. 12, producers	27.00
Aluminum, No. 12, remelt	25.00 to 26.00
Zinc, E. St. Louis, Ill	8.70 to 8.75











Personal

John J. Anderson has succeeded George J. Riexinger as foreman of the equipment foundry of the American Radiator Co., North Buffalo, N. Y.

John S. Gullborg, president Alemite Die Casting & Mfg. Co., Chicago, was the principal speaker at the meeting of the Chicago Foundrymen's club held Dec. 12.

W. J. Adams, formerly foreman of the foundry of the Wolf Mfg. Corp., Los Angeles, has been made foreman of the foundry of the Republic Brass & Mfg. Co., that city.

Hubert C. Smith, formerly superintendent of the foundry department, Union Iron Works, Spokane, Wash., now is superintendent of the foundry department of the Layne & Bowler Corp., Los Angeles.

E. J. Lowry, Hickman, Williams & Co., Chicago, addressed the members of the Quad-City Foundrymen's association Dec. 14, on "Pig Iron and the Relation of Elements and Their Resultant Effects on Castings."

J. A. Engle has resigned his position as foreman of the wood and metal pattern departments of the J. I. Case Threshing Machine Co., Racine, Wis., effective Jan. 1. Mr. Engle has been connected with the Case company for the past 15 years, previous to which he was with the Western Electric Co., Hawthorne, Chicago.

William J. Weir has been made superintendent of the steel foundries of the Locomotive Finished Material Co., Atcheson, Kansas. Mr. Weir resigned as superintendent of the Springfield, Ohio plant of the Ohio Steel Foundry Co. to accept the position in Kansas. He formerly was connected with the West Steel Casting Co., Cleveland, and previous to that with the Erie Forge & Foundry Co., Erie, Pa.

George P. Baldwin, general merchandizing manager of the General Electric Co., Schenectady, N. Y., was elected vice president of the company at a recent meeting. Mr. Baldwin will have charge of the activities connected with the electrification of steam railroads with headquarters at 120 Broadway, New York. Charles E. Patterson, vice president in charge of finance since 1920, has been placed in charge of merchandizing activities with headquarters at Bridgeport, Conn.

Make Sales Change

J. N. Walter has been made general sales manager of the Oxweld Acetylene Co., 30 East 42nd St., New York. L. D. Burnett succeeds Mr. Walker as eastern department sales manager and Z. T. Davis Jr., has been advanced to assistant sales manager eastern department.

British Discuss Research

The annual general meeting of the British Cast Iron Research association was held in London at the Midland Grand hotel, Nov. 18, 1925. Sir. John Dewrance, Dewrance & Co., London, chairman and director of several engineering firms and associations, was re-elected president of the association. The following were elected vice presidents: Sir William Ellis, chairman of Davy Brothers, Ltd., Sheffield, and managing director of John Brown & Co., Ltd., Sheffield; F. W. Firth, managing director of the Brightside Foundry & Engineering Co., Ltd., Sheffield; W. B. M. Jackson, chairman of Sheepbridge Stokes Centrifugal Castings, Ltd., Chesterfield; C. E. Lloyd, chairman of N. Hingley & Sons, Ltd.; Dudley G. Pate, director of United Foundry Co., Ltd., Glasgow; Commander Sir A. Trevor Dawson, vice chairman and managing director of Vickers, Ltd.; S. Hunter and A. P. M. Fleming.

J. T. Goodwin, C. Retallack, S. H. Russell, H. Shannon, Oliver Stubbs, W. H. Whitehouse, J. N. Wiggins, W. R. Bates, W. Jolley, J. E. Hurst, W. E. Hale, Prof. T. Turner and T. Bladen were elected members of the council. J. G. Pearce, Birmingham, is director of the British Cast Iron Research association.

At the luncheon which followed the meeting Sir. William Ellis said that the difficulties today are to some extent not so much in cast iron as in steel castings, and he wondered whether as much progress has been made in the physical properties of iron castings as has been made in various directions in connection with steel. He stated that engineers should specialize in foundry work. Sir John Dewrance pointed out that foundrymen in Great Britain cannot afford to let other countries do the research for them and then reap the benefit. He stated that the nation which is in the front in research and knowledge stands the best chance of being in the forefront of industry. He referred to the fact that the government grant through the department of scientific and industrial research will expire in 1926, and that the association will have to make itself self-supporting.

Engineer vice-admiral Sir Robert Dickinson said that although present foundry practice is no doubt splendid, he was doubtful whether it was equal to modern requirements, and he stated that the percentage of failures in castings is much too high. He alluded to the work which has been done in connection with pearlitic cast iron and said that if the results of the research work were successful, some of the troubles recently experienced in diesel engine castings would be removed.

C. E. Lloyd pointed out that many of the best foundry workmen go to America. He said that furnaces are not easily governable and that even when materials of exactly the same apparent constitution are manufactured they do not always have the same physical properties. He further stated that one of the differences between Great Britain and the United States is that the latter country is much more ready to share information than Britain.

Concrete Pit in Foundry

Question: Some three or four years we read in THE FOUNDRY something about a concrete pit which we think was built in the foundry of the Niles Tool Works, Hamilton, O. We contemplate building a concrete pit in our foundry and would like to refer to this article for information. If this is not available we shall appreciate any information you may have on the subject, or the addresses of people to whom we might write for data and sketches. The pit we have in mind must be large enough to take our heaviest castings and still be adjustable to an extent that will render it economical when used for smaller jobs. What is the minimum thickness of sand that should be allowed between a casting and the walls and bottom of the pit.

Answer: The article to which you refer dealt with the concrete pits in the new foundry of the Westinghouse Electric & Manufacturing Co., Lester, Pa., and appeared in the Dec. 15, 1920, issue of THE FOUNDRY. Some of these pits are circular and others are rectangular with a uniform depth of 10 feet. One of the rectangular pits is 16x20 feet and each of the other pits is 20x64 feet. The pits are arranged in such a manner that they may be divided into several sections. Steel angles anchored in the wall project at 5-foot spaces to support cast iron stop-off plates. In this way the pit may be adjusted to any length in multiples of 5 feet up to the total length. This idea may be adapted to meet the requirements of any foundry. The minimum thickness of sand between the casting and the concrete will depend on the shape and size of the casting and will be the same as if a

flask was employed. A coke bed is a necessary requisite for nearly all castings made in a pit and in many instances room must be provided for the molder between the pattern and the side walls. Basing our opinion on these two factors we should suggest you design the pit with at least 24 inches space between your largest pattern and the walls of the pit and with 12 inches underneath.

Discuss Plant Control

By controlling raw materials and all important foundry operations, the uncertainties in foundry defects practically may be eliminated, according to A. A. Grubb, director of laboratories, Ohio Brass Co., Mansfield, O., who spoke to a large group of foundrymen at the December meeting of the New England Foundrymen's association at Boston. With the aid of slides Mr. Grubb described in detail the foundry practice at the Mansfield plant, as well as the general subject of technical control in foundry operation. He stated that one of the first things to control is the character of all raw material entering the plant. The next step is to control the intermediate processes such as sand and cores. It is important to bring the laboratory into the shop, that is, to have testing in the different departments a matter of routine and general practice. The individual foundrymen should have free access to testing facilities so that if he questions the quality of the sand in his heap, he may take a specimen and have it tested before using the sand.

Mr. Grubb devoted considerable time to the question of reclaiming sand. His remarks were followed by a description of the practice at the Brown & Sharpe Mfg. Co., Providence, R. I., which was given by P. F. Kiley. He stated that this foundry was going the limit in the way of reclaiming sand. He said they used gangway sweepings mixed with prepared clay, and obtained good results. S. A. Saunders, Providence, R. I., showed a series of interesting microphotographs taken during the process of reclaiming sands. These tended to prove that the individual sand grains, instead of becoming smaller through repeated use in the foundry, actually were built up through the baking action on the thin clay layer which adhered to them. Thus for a period of four or five days sand which is used over and over again increases in porosity rather than otherwise. Neither the speaker nor others at the meeting were able to give definite data on how far this process will continue.

British Foundryman Dies

Isaac Enoch Lester, managing director of Charles Akrill & Co., Ltd., West Bromwich, England, died suddenly at his residence in Edgebarton, Birmingham from heart failure on Friday, Nov. 27. He was the son of John Lester, former manager of the Patent Shaft & Axletree Steel Co., Ltd., Wednesbury. He received his scientific education at the Midland institute, Birmingham, and the Royal School of Mines, London. He specialized in foundry work and became foundry manager at Kynochs, Ltd., Birmingham, casting the first large

ISACC ENOCH LESTER

shells made by that company. During a period of five years residence in India he built the first foundry for the East Indian Railway Co., producing the castings for the first locomotive built in that country. For many years he was a prominent member of the Birmingham Metallurgical society and the Straffordshire Iron and Steel institute, being an ex-president of the society.

Select District Agents

The Rodman Chemical Co., Verona, Pa., has appointed O. P. Muehlemeyer, Rockford, Ill., as district manager of Illinois, Iowa and Wisconsin. Mr. Muehlemeyer formerly was metallurgist for Barber-Coleman Co., Rockford, Ill.

The Mikesell Pattern Works, Los Angeles, has moved to its new quarters at 2375 East Twenty-seventh street, J. C. Mikesell is owner.

Foundrymen To Consider Permanent Molds

A symposium on permanent and long life mold castings will be of special interest to foundrymen planning to attend the second International Foundrymen's congress to be held in Detroit the week of Sept. 27, 1926. This phase of foundry practice, which has assumed considerable importance in the past few years, will be discussed thoroughly at the meeting, it being planned to cover nonferrous, iron and steel practice in this country and abroad. The Gothias and similar processes used in England and France will be explained. The American practice developed in using oil cooled molds for pistons, the process of using zinc impregnated molds and many other special developments in iron, steel and the nonferrous field will be considered. The committee organizing the symposium is under the direction of Jesse L. Jones, metallurgist, the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This committee will welcome information from those who have been instrumental in developing or carrying on work in this field of casting procedure.

Appoint Representative

Machinists Supply Co., Pittsburgh, will represent N. A. Strand & Co., Chicago, in the western half of Pennsylvania and the northwestern part of West Virginia. Beals, McCarthy & Rogers Inc., will represent the Strand company in the western part of New York.

Change Company Name

The name of the Mechanical Pattern Works, Inc., Los Angeles, has been changed to Mechanical Pattern & Foundry Co., Inc., and the plant has been moved to 4545 Pacific avenue.

Buys Equipment Firm

Equipment, patterns and patents of the F. A. Coleman Co., Cleveland, have been purchased by the Foundry Equipment Co., Cleveland.

Made Sales Manager

Guy E. Wyatt has been appointed advertising manager and assistant sales manager of the American Foundry Equipment Co. New York, succeeding Robert H. Kelly who recently resigned after a connection in this capacity for over 10 years.

Inquiries Brighten Prospects

Increased Buying Anticipated After First of the Year as Foundrymen Consider Replacements and New Construction—Foreign Sales Given

SALES of foundry equipment decreased in volume in December, this falling off being attributed to the lull during the latter half developing out of the holiday season and the fact that plant inventories usually are taken at that time. One exception was noted in connection with the sale of molding machines, this line of equipment maintaining a fairly high total for the month. On the whole, business during the past month was slightly under that secured during the corresponding period a year ago, an unusual buying spurt having been a feature of the market in 1924.

Prospects for a substantial pick-up in business after the first of the year are exceptionally bright, for inquiries are being brought out in good numbers. Several large foundries are planning extensive replacements and some new construction is noted. Revision of existing equipment to reduce production costs is noted.

Unfilled orders for foundry equipment at the end of October, as reported to the department of commerce by the manufacturers, fell off in value as compared with September, but gained over October a year ago. The value of unfilled orders was $518,795 as compared with $544,042 in September and $329,061 in October, 1924. However, October sales and shipments each gained over September as well as October a year ago. Sales were valued at $425,054 as compared with $296,438 in September and $259,871 in October last year. Shipments were valued at $400,645, as against $351,121 in September and $252,580 in October, 1924.

Inventory Period Causes Buying Delay

INQUIRY for foundry equipment in the Chicago district has been feeling the heavy hand of the holiday and inventory period, but with the turn of the year equipment buyers look for much pending inquiry to be closed. Three sand mixers have been sold to the Crane Co., for its Chicago plant, and one each to the Blackmere Pump Co., Grand Rapids, Mich., and the San Antonio Machinery & Supply Co., San Antonio, Tex., by the National Engineering Co., Chicago. The Crane Co. is understood to be placing equipment for the malleable foundry it has had under way for some time and the Blackmere Pump Co., Petoskey, Mich., is buying for the new foundry it is building at Grand Rapids. The Vancouver Engineering Works, Ltd., Vancouver, B. C., and the Miller Brass Foundry, Torreon, Mexico, have secured sandblast equipment, the Allis-Chalmers Mfg. Co., Milwaukee, has purchased ventilation equipment and the Clark Equipment Co., Buchanan, Mich., has taken sandblast and dust arrester equipment from the Pangborn Corp., Hagerstown, Md. Tumbling mill equipment has been purchased by the Buick Motor Co., Flint, Mich., the Link-Belt Co., Indianapolis, and the National Sewing Machine Co., Belvidere, Ill., from the W. W. Sly Mfg. Co., Cleveland, while the Saginaw Products Co., Saginaw, Mich., has secured sandblast rooms from the same manufacturer. The St. Clair Foundry Co., Belleville, Ill., has closed on a cupola from the J. W. Paxson Co., Philadelphia, as has the Riverside Foundry & Galvanizing Co., Kalamazoo, Mich. Two molding machines have been sold the Nugent Steel Castings Co., Chicago, and one each to the American Manganese Steel Co., Chicago Heights, Ill., the Arkansas Foundry Co., Little Rock, Ark., and the Shierman Concrete Pipe Co., Little Rock, by the Herman Pneumatic Machine Co., Zelienople, Pa.

New York Inquiries Heavy

REFLECTING the holiday and inventory season, foundry equipment trading in the New York metropolitan district has shown a further decline. Nevertheless, a fairly good volume of inquiry is on hand, more perhaps than in some time past and as a result sellers are hopeful that the next quarter will show a decided gain over the one now closing. One encouraging feature is the volume of railroad work that has been placed recently. This, it is believed, will be reflected in greater activity at a number of foundries. At present the most activity is to be found at foundries specializing in heating equipment. Recent orders include three large cupolas for the Florence Pipe, Foundry & Machine Co., Florence, N. J. and one cupola for the George D. Webster Foundry Co., Baltimore, these orders going to the J. W. Paxson Co., Philadelphia. Other interests who have closed recently on equipment with this builder are the Southwark Mfg. Co., Camden, N. J., which has taken a tumbling barrel, and the Amtorg Trading Corp., New York, has closed on sand blast equipment to the Paxson company for shipment to Russia. A molding machine has been sold to the Hay Foundry & Iron Works, Newark, N. J., by the Herman Pneumatic Machine Co., Zelienople, Pa., while the American Radiator Co., Bayonne, N. J., has taken sand mixing machinery from the National Engineering Co., Chicago. Sandblast equipment has been ordered by the Wheeler Condenser & Engine Co., Carteret, N. J., and the H. H. Franklin Mfg. Co., Syracuse, N. Y., from the Pangborn Corp., Hagerstown, Md. Prospective buyers are the Flynn & Emerich Corp., Baltimore, which now is figuring on 400 tons of structural steel for a foundry addition; and the General Steel Casting & Machine Co. Inc., Newark, which contemplates rebuilding the portion of its plant which recently was damaged by fire. The De Laval Steam Turbine Co., Trenton, N. J., has closed on a cupola and the Andes Foundry Co., Lancaster, Pa., on a cupola, both orders going to the Whiting Corp. Both concerns only recently have let contracts for foundry additions.

The William J. Sweet Foundry Co.,

Irvington, N. J., has purchased a 500-pound electric furnace from the Pittsburgh Electric Furnace Corp., Pittsburgh.

Pittsburgh Buys Molding Machines

ORDERS and inquiries for molding machines featured the foundry equipment market of the early part of December in the Pittsburgh area. Some inquiries were expected to be closed before the year ended; others were to be held up until after the holiday and inventory-taking periods. The equipment demand is attributed to foundry operations, which improved measurably in the closing two months of the year, particularly in the steel foundry group which operated at such a low point for such a large part of 1925. The Herman Pneumatic Machine Co. states that it never started a new year when prospects were brighter than at present. Numerous foundries contemplate changing to machine molding practice entirely in 1926, and some have inquired tentatively for the equipment. Others have issued formal inquiries which shortly will turn into orders. Recent orders include one for McConway & Torley Co., Pittsburgh and the Gurney Foundry Co., Toronto, Ont. The Meadville Malleable Iron Co., Meadville, Pa., has purchased sandblast equipment from the Pangborn Corp., Hagerstown, Md., and the Pittsburgh Roll Corp., Pittsburgh has closed on two furnaces for core ovens with the Mayor Fuel Saving Furnace Co., Cleveland. Vibrator and shakeout equipment has been ordered by the Pittsburgh Plate Glass Co., Creighton, Pa., from the Stoney Foundry Engineering & Equipment Co., Cleveland. Several inquiries for core ovens, cupolas, hoists, monorail systems, tumbling barrels, blowers, etc., still are pending here and action on these will be taken early in 1926. The Andes Foundry Co., Lancaster, Pa., has awarded a general contract for an addition and probably will buy some equipment. The Mt. Morris Valve Corp., Mt. Morris, N. Y., plans to have its building ready for machinery and equipment early in January, and shortly will be placing orders. The Pittsburgh Malleable Iron Co., Pittsburgh, is disposing of a $400,000 bond issue, proceeds for which will be utilized for both buildings and equipment. The United States Aluminum Co., Arnold, Pa., bought a 7½-ton overhead crane with 76-foot span from the Northern Engineering Works, Detroit.

New England Demand Active

DEMAND for foundry equipment is active considering the time of year. Recent sales include sand handling and treating equipment and many molding machines. Taylor & Fenn Co., Hartford, Conn.; the Bridgeport Malleable Iron Works, Bridgeport, Conn.; the Reed Prentice Co., Worcester, Mass.; L. F. Fales, Walpole, Mass., and the Whitin Machine Works, Whitinsville, Mass. have purchased sand mixing machines from the Royer Foundry & Machine Co., Wilkes-Barre, Pa. The Whitin company also bought molding machines and other equipment. The Plainville Casting Co., Plainville, Conn., has secured sandblast equipment from the Pangborn Corp., Hagerstown, Md., and the Draper Corp., Hopedale, Mass., has purchased a tilted sandblast mill from the W. W. Sly Mfg. Co., Cleveland. The Eastern Malleable Iron Co., Naugatuck, Conn., which purchased a coal pulverizer several months ago from the Grindle Fuel Equipment Co., Harvey, Ill., has ordered four additional units for installation in its other foundries. Many New England foundries are on the point of buying major equipment, and heavy sales are looked for after the first of the year. Two Massachusetts foundries are in the market for electric furnaces.

Cleveland Buying Slackens

WITH one or two exceptions, manufacturers of foundry equipment in the Cleveland territory note a slackening demand for their product. Buyers are waiting until after the first of the year to close on equipment that may be required. However, demand for molding machines continues fairly satisfactory, a recent order calling for two large machines for the Ferro Machine & Foundry Co., Cleveland, this business going to the Stoney Foundry Engineering & Equipment Co., Cleveland. Among the cleaning room equipment recently purchased are included shakeout bails for the Elmwood Castings Co., Cincinnati. and the Columbia Sanitary Mfg. Co., Louisville, Ky., from the Stoney Foundry Engineering & Equipment Co., Cleveland; tumbling mill equipment for Dodge Bros., Detroit, Willys-Overland Co., Toledo, O., H. Wetter Mfg. Co., South Pittsburgh, Tenn., Dayton Malleable Iron Co., Dayton, O., the Dixie Foundry Co., Cleveland, Tenn., and the Fanner Mfg. Co., Cleveland, and sandblast rooms for the American Car & Foundry Co., Huntington, W. Va., from the W. W. Sly Mfg. Co., Cleveland. Dust arrester equipment has been purchased by the Packard Motor Car Co., Detroit, from the Pangborn Corp., Hagerstown, Md., and tumbling barrel equipment has been secured by the American Radiator Co., Buffalo, from J. W. Paxson Co., Philadelphia. Sand mixing machinery has been sold to the Ohio Brass Co., Mansfield, O., by the National Engineering Co., Chicago. The Otis Elevator Co., Buffalo, has contracted for a 3-ton electric furnace from the Pittsburgh Furnace Corp., Pittsburgh.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Muskegon Piston Ring Co., Muskegon Mich., has awarded a contract for a $20,000 factory unit, 80x157 feet.

Los Angeles Foundry Co., Los Angeles, is installing a new core oven and molding machines.

The plant of the Etowah Foundry & Machine Co., of Gadsden, Ala., recently was badly damaged by fire, together with its equipment. The damage is estimated at $60,000 with insurance of $33,500. The company, whose president is C. P. Butcher, manufactures sanitary appliances and building castings.

Everready Iron Works, Brooklyn, N. Y., has been incorporated with $50,000 capital to build and operate an iron foundry by J. Goldberg and M. Leibel. K. Greenberg, 51 Chambers street, New York, is attorney.

Asheville Supply & Foundry Co., D. S. Hildebrand president, Eagle street, Asheville, N. C., has bought two acres and will build fabricating shop and storage 79x190 feet, steel storage 24x80 feet, brass foundry 30x35 feet, gray iron foundry 60x80, pattern storage 50x50 feet, pattern shop 30x35 feet, welding shop 20x25 feet, forge shop 40x50 feet, car repair shop 30x50 feet, machine shop 50x100 feet, pipe and fitting storage 50x80feet, heavy machinery storage 50x100 feet and 2-story office building.

L. G. Perkins Foundry, Fresno, Calif., is adding 75x100 feet to its molding floor to care for increased demand for castings.

Dill Foundry Co., Rushville, Ind., William Dill, manager, will build a 1-story addition 140x180 feet.

Marine City Motor Casting Co., Marine City, Mich., will install a new core oven early in 1926, to increase its output.

George Cutter Co., 407 South Notre Dame street, South Bend, Ind., is planning factory group.

Brady Brass Co., Fourteenth and Henderson streets, Jersey City, N. J., is adding to its plant, 2-stories 24x76 feet.

American Radiator Co., 3400 Thirty-sixth avenue north, Birmingham, Ala., is considering an addition to its plant.

Wilson Foundry Co., Pontiac, Mich., is installing additional machinery and equipment to increase its output.

Louis Sachs, Wilson avenue, Newark, N. J., will build a 1-story addition to its foundry plant.

William J. Collins Foundry Co., Milford, Mass., recently suffered loss by fire and is considering plans for rebuilding.

Scully Pattern Mfg. Co., J. P. Moran secretary, 308 Euclid avenue, Cleveland, is having preliminary plans made for a plant. (Noted Nov. 15).

St. Clair Foundry Co., Centralia, Ill., has started construction on an addition to its plant, Bauer Construction Co. having the general contract. (Noted Oct. 15).

Colorado Fuel & Iron Co., Pueblo, Colo., will build a modern cast iron pipe foundry capable of extension to meet western requirements.

H. B. Smith Co., Westfield, Mass., manufacturer of heating appliances, is having plans made for a machine shop and a core room.

Andes Foundry Co., Eugene Andes president, Ann and Walnut streets, Lancaster, Pa., is having plans made for a 1-story foundry addition 50x154 feet.

Liddell Co., North Church street, Charlotte, N. C., J. T. Beatty general manager, will remodel its plant to increase production of cotton gins and other machinery.

Thomasville Iron Works, Inc., Thomasville, Ga., manufacturer of sugar machinery, will build a 1-story foundry 80x100 feet to double the castings capacity.

St. Clair Foundry Co., Cleveland, has been incorporated with $10,000 capital by Harry F. Hayne, Lewis E. Poirer, Arthur J. Crinski, John G. Kowacki and Anthony Rutkowski.

Addition to the plant of the American Cast Iron Pipe Co., Acipco street, Birmingham, Ala., being built, steel work being in place. Will have capacity for 500 tons of cast iron pipe daily.

General Casting & Machine Co. Inc., 8 Lister avenue, Newark, N. J., is having plans made for rebuilding its burned foundry. Garfield Kilpatrick is president. (Noted Nov. 1).

Blackhawk Foundry & Machine Co., Davenport, Iowa, Walter Voss president, is having plans made for a foundry addition 110x300 feet, the first unit 100x110 feet, to be built at once.

John Deere Harvester Works, Oscar Echerman manager, 1312 Thirteenth street, Moline, will build a steel storage shed 80x200 feet, general contract being let to Brissman & Co., Moline Trust building, Moline.

Flynn & Emrich Co., 305 North Holiday street, Baltimore, manufacturer of stokers, will build a 1-story foundry addition 100x260 feet. W. S. Austin, Maryland Trust building, is engineer.

Armitage Pattern & Casting Co., 1925 Elston avenue, Chicago, has been incorporated with $10,000 capital to manufacture wood and metal patterns by E. L. Seiffert, L. W. Seiffert, A. J. Andrews and R. M. Christenson. Herron, Johnson, Burita & Herron, 160 North LaSalle street, are correspondents.

Triangle Tool & Pattern Co., 207 Brady avenue, Detroit, is building a 1- and 2-story plant 50x100 feet. General contract to F. M. Stokes, 6432 Northfield avenue. (Noted Nov. 15).

Marshalltown Mfg. Co. 810 Nevada street, Marshalltown, Iowa, manufacturer of presses and shears, is having plans made for a 3-story addition 60x75 feet. F. M. Farber is secretary and general manager.

Prescott Co., Menominee, Mich., manufacturer of machinery for sawmills, mine pumps and similar purposes is building additions, enlarging its machine shop to 90x140 feet, a 3-story addition to its pattern storage.

A. P. Grimm Foundry Co., Bridgewood, N. J., has been incorporated with $100,000 capital by Albert P. Grimm, Margaret V. Grimm and Lester M. Grimm, Raritan, N. J. Daniel Beckman, Somerville, N. J., is attorney.

Standard Sanitary Mfg. Co., Bessemer building, Pittsburgh, will build an addition to its plant at 558 Jackson avenue, Long Island City, N. Y. General contract has been let to J. H. Wiles, 8 West Fortieth street, New York.

New Trade Publications

CLAM SHELL BUCKETS.—A 14-page folder is being distributed by the Hayward Co., New York, describing the application of the clam shell bucket for various operations in the foundry or plant.

MATERIAL HANDLING.—The Link-Belt Co., Chicago, has issued a 32-page booklet showing the various types of handling equipment for use in foundries. Conveyors, sand reclaimers and sand reconditioners are described. The booklet contains many illustrations of the equipment in use.

BLOWERS AND EXHAUSTERS—Multistage centrifugal type blowers and exhausters manufactured by the Allen & Billmyre Co. Inc., New York, are described in detail in a bulletin by that company.

HAND SAWS—How a Disston hand saw is made, from the blank to the completed tool is described in an interesting pamphlet by Henry Disston & Sons, Philadelphia. The process is followed step by step and reasons are given for the care taken to produce a balanced and highly refined result.

GRINDERS—The Transmission Ball Bearing Co., Buffalo, issued a bulletin on a swing frame grinder. The grinder is designed for heavy duty grinding and is electrically driven.

COAL HANDLING EQUIPMENT—Freeman-Riff Co., Terre Haute, Ind., is capitalizing its installation of coal-handling, storing and weighing equipment at Purdue university, Lafayette, Ind., by a broadside covering this installation in detail and also giving a list of other installations.

DRILLS AND REAMERS—Half a dozen leaflets and booklets have been prepared by the Morse Twist Drill & Machine Co., New Bedford, Mass., covering several lines of tools in its line, including, drills, reamers, countersinks, bits and others. Another recent publication by this company is a machinist's practical guide, containing information and statistical tables of standards, gages and other information.

SAND BLAST MACHINES—The Pangborn Corp., Hagerstown, Md., has issued an 8-page bulletin describing a new sandblast barrel, ventilation and dust suppression apparatus, dust exhauster and sand blast abrasives. The important features and application of each to the foundry is given.

SYNCHRONOUS MOTORS—Belted synchronous motors for various uses are described in a bulletin issued by the Electric Machinery Mfg. Co., Minneapolis. Both the direct connected exciter and the separate exciter types are shown and the principal features of construction are noted. These motors may be used to drive air compressors, pumps, line shafts, fans, blowers, etc.

PYROMETERS—Potentiometer pyrometers are described in a 55-page catalog published by Leeds & Northrup Co., Philadelphia. The catalog is well illustrated with photographs of equipment installed in various industries. The use of pyrometers for heat control is described. A list of accessories and prices also is given.

DESIGN AND CONSTRUCTION—Frank D. Chase, Inc., Chicago, has issued a booklet describing its service to manufacturers. The various factors such as plant location, layout, expansion, material handling, building design and construction are explained and their relation to industry is given. The booklet is illustrated from photographs of various types of buildings that have been designed or constructed by the company.

PORTABLE AIR HOISTS—A booklet showing the air turbine hoist and describing its application has been issued by the Sullivan Machinery Co., Chicago. The hoists are compact and operate on 50 pounds air pressure They may be used to drag castings around the foundry or for hoisting purposes.

SAND HANDLING—Foundrymen always are interested in the problem of sand handling and a new booklet on sand preparing and conveying equipment is worthy of attention and study. This booklet is published by the Link-Belt Co., Chicago.

FLOW METERS—Mechanically and electrically operated flow meters for measuring the flow of fluids and gases through pipes, as developed by General Electric Co., Schenectady, N. Y., are described and explained in a 43-page bulletin just published. These meters indicate, record and register the flow or pressure.

CRUCIBLES—Plumbago Crucible Manufacturers' Publicity bureau, 90 West street, New York, has issued a booklet to show users how crucible costs may be cut. Suggestions are made as to how crucibles may be stored, handled and used to give minimum breakage and maximum service. Data are given on melting points, composition of alloys, tensile strengths and standard crucible sizes.

MOTORS—Ball and roller bearing motors manufactured by the Reliance Electric & Engineering Co., Cleveland, are described in a 15-page booklet. Both the open and closed motors are shown and the description of each given. Tables showing the various sizes of motors and the dimensions are contained as are illustrations showing some installations of these motors.

CLAMPS—A new type of clamp for holding wood or metal parts while drilling or performing other machine operations is being sent out by the Practical Die & Specialty Mfg. Co., Chicago. Its advantages are fully illustrated.